MARCH 1953

HUGO GERNSBACK, *Editor*

Science-Fiction PLUS

K

preview of the future

Cosmatomic Flyer

Science-Fiction Stories by

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Philip José Farmer
John Scott Campbell
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and others

35¢

THE IMPACT OF SCIENCE-FICTION ON WORLD PROGRESS*...

by HUGO GERNSBACK

An imperceptible revolution has quietly taken place during the past 25 years—a revolution probably unparalleled in man's history. The revolution is the terrific impact of Science-Fiction on the world and world progress. Curiously enough, the agency responsible for Science-Fiction—the authors, the publishers, and the readers, seem little aware of this revolution and the *real* meaning and import of the dynamic force that carries it forward.

Let me clarify the term Science-Fiction. When I speak of it I mean the truly, scientific, prophetic *Science*-Fiction with the full accent on SCIENCE. I emphatically do not mean the fairy tale brand, the weird or fantastic type of what mistakenly masquerades under the name of Science-Fiction today. I find no fault with fairy tales, weird and fantastic stories. Some of them are excellent for their entertainment value, as amply proved by Edgar Allan Poe and other masters, but when they are advertised as Science-Fiction, then I must firmly protest.

Twenty-five years ago, before Science-Fiction had become an organized and recognized force—the broad smoothly-flowing literary river it is today—we had but a weak trickle of occasional stories and here and there a book or two. It was a rarity when an author wrote more than one or two Science-Fiction stories. Rarer yet were series of Science-Fiction books, such as those of the masters Jules Verne and H. G. Wells.

The truth is that in the early, formative years Science-Fiction was hardly considered respectable! Most people, including newspaper and magazine editors, considered Science-Fiction as a crackpot endeavor. It just was not considered serious at the time. Our big newspapers and mass circulation magazines thought it beneath their dignity to print such "nonsense." Indeed, most authors had the same conviction. I well remember when, in 1911, I first started to print Science-Fiction stories *regularly* in some of my magazines. Most authors approached on the subject agreed to do a few stories, *provided I did not use their real names!*

Little by little this feeling changed. Then, after I had brought into life the world's first Science-Fiction magazine, "AMAZING STORIES," in 1926, suddenly Science-Fiction became respectable! The intelligentsia, scientists, professors of various types, became regular readers—even the nobility, to wit Lord Mountbatten, and others, enrolled in the ranks.

For the first time in history there had been created a pleasant vehicle on which you could ride into the future uninterruptedly for practically no money at all.

If you were an engineer, or an industrialist and had imagination, Science-Fiction often gave you valuable hints or stimulated your imagination sufficiently so you could derive material benefit from it. A number of inventions, processes, machines thus came to life thanks to Science-Fiction.

Inventors, manufacturers, and others understandingly do not like to admit that a Science-Fiction story sparked them into activity, on the road to a new invention or a new machine, but it is an established fact that a host of Science-Fiction ideas have been successfully translated into paying realities.

There is often a considerable lapse of time between a Science-Fiction idea and its fulfillment. Thus it took Jules Verne's submarine, *The Nautilus,* so vividly described in *20,000 Leagues Under the Sea,* 27 years to become an actuality. H. G. Wells's public (i.e., Broadcast) Loud-speakers, so exactly portrayed in his novel, *When the Sleeper Wakes,* in 1899, came into general use only 25 years later. Radar, accurately predicted in all its technical elements in my novel *RALPH 124C 41+* in 1911, did not become a reality till about 27 years later. Many similar examples can be cited where important inventions, processes, and trends accurately predicted in old Science-Fiction stories are commonplace today.

Frequently, too, technical predictions were made where the author thought only of a single use for the idea or device. Years later the identical idea may be used for an entirely different—and much more important—purpose. I will give only one illustration here. In my former magazine, "SCIENCE & INVENTION," for February 1925, I described a fanciful device called "The Radio Teledactyl." In reality this was a teledoctor—a doctor who visits his patients via radio and television. In front of the doctor are two articulated levers which he can manipulate like hands. The patient would have a similar device in his house (or in the hospital). The distant teledactyl is watched by the doctor from his office by 2-way television. It is operated by radio. Thus he can palpate the patient on any spot of his anatomy, take the patient's temperature, listen to his heartbeat, take his blood pressure, and so forth. The doctor, in short, now has acquired *distant hands.*

Nowadays the identical device is used *not* by med-

Continued on back inside cover

* *Address Read Before 10th World Science Fiction Convention, Chicago, August 31, 1952.*

Science-Fiction PLUS

preview of the future

MARCH, 1953 **Vol. I, No. 1**

NOVELETTES

SHORT STORIES

STORY BEHIND THE COVER

ARTICLES

FEATURES

This design, symbolizing science-fiction, is displayed with all stories of a *serious scientific-technical* trend. Such stories contain new ideas which are certain to be realized in the future.

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Exploration of Mars

by HUGO GERNSBACK

(Illustrations by Frank R. Paul)

If there is one outside world about which we know a great deal, it certainly is the planet Mars. Astronomers for ages have closely scrutinized our neighbor, while scientists today agree that the red planet is far advanced in its evolution. A dying world—its probable civilization is many hundreds of millions of years in advance of ours.

What can we expect of such enlightened civilization, its culture, its progress? How do they build their canals? How does a dying world feed its teeming billions? How and where do Martians live? What type of transportation do they use? If Martians are so far advanced, why don't they visit us?

These and dozens of other burning questions that have puzzled us for years are lucidly explained—often most convincingly—by the author-scientist of this absorbing story.

Male Martian. He is over 10 feet tall.

Grego Banshuck, Explorer

SF

"The study of Mars proves that planet to occupy earthwise the post of prophet . . . For it is by way of foretelling our future."

—Professor Percival Lowell in his book, "Mars as the Abode of Life."

FAS First to Explore Mars

October 10, 1949, may well be referred to by historians as the most important date of the twentieth century! On that memorable day, at 4:56 p.m. Mountain Standard *Earth* Time, the intrepid explorer, Grego Banshuck, landed his atom-powered space flyer on Mars, the fourth planet of the solar system.

For obvious security reasons, I have only now been permitted to tell the full facts to the world.

Financed by FAS, the Federation of American Scientists, the world-famed physicist-inventor, atomic pioneer, and explorer had labored for more than a year on his space flyer in the lonely fastness of Nevada's Ralston Desert. Here a crew of 22 FAS physicists and college professors toiled valiantly and efficiently in five air-conditioned Quonset huts. These huts, stocked with food, tools, machine shop, and a thousand other items, also were the living quarters for the secrecy-sworn band of atomic space pioneers.

All supplies, material, food, etc., were flown in with special helicopters of the U.S. Air Force by hand-picked personnel. While the entire cost of the project was financed by FAS, the U.S. Government lent its complete support, recognizing the great importance of the historic undertaking.

The Space Flyer

Arrangements made early in 1948 provided that, if the new and revolutionary space flyer were successful, the U.S. Department of Defense then would take over the building of all further Banshuck space machines. In turn, the U.S. would supply the precious atomic fuel.

For security reasons I am not permitted to state how the Banshuck atomic flyer operates, nor what the exact fuel consists of. Only a most sketchy description is therefore possible:

The historic space machine, christened MARS I, was blimp-shaped—its smooth outside surface broken only slightly by three fan-shaped ejection vents and the radar antennas.

Except for 24 two-inch thick quartz portholes windows, the MARS I was constructed entirely of tempered titamagnesium 4. It measured 65 feet long by 12 feet in diameter. Its total weight, including its six-man crew, was approximately 52 tons.

Without question, Grego Banshuck's greatest contribution to interplanetary space-flight is his brilliant atom-negative gravitator. He realized years ago that purely rocket-powered space ships would never be practical because of the tremendous amount of fuel required to free the ship from terrestrial gravitation at the start of the trip. Once out in space—after the first 10,000 miles—rocket propulsion is comparatively simple.

Dr. Banshuck is the first to have overcome the problem, which has baffled astro-engineers for decades, of developing the concentration of energy necessary for a successful launching into space beyond the earth's gravitational pull.

Atom-Negative Gravitator

Using Dr. Einstein's famed equation, $E = mc^2$—which made the release of atomic energy possible—Banshuck after long experiments succeeded in discovering the principle of his atom-negative gravitator.

Einstein's $E = mc^2$ simply means that the energy contained in any particle of matter is equal to the *mass* of the body in grams, multiplied by the square of the velocity of light. Banshuck kept his eye on that *mass*, because mass is intimately linked with gravitation, as any bright schoolboy knows.

For the layman better to understand Einstein's equation, it can be translated as follows: Take 2 pounds of coal and convert it *entirely* into energy. This conversion will yield over 25 billion kilowatt hours of electric current—more than all the electric power plants in U.S. can generate in 60 days, running day and night without stopping.

But Einstein also proved long ago that *energy has mass!* Dr. Banshuck therefore simply juggled Einstein's $E = mc^2$ equation in such a manner that *his atomic generator constantly transforms energy into mass.* If a sphere (the space ship) generates and expels a constant stream of mass at great speed, a tremendous reaction is given to the sphere. Imagine a 10-inch cannon firing, at great speed, a projectile weighing as much as the Empire State Building. The resulting back-kick of the gun would be titanic.

Mass-Ejection Propulsion

Banshuck's principle of *mass ejection* at high speed cannot be compared even remotely with a rocket which uses only hot gases, and is therefore ludicrous by comparison. Rocket propulsion compared to the atom-negative gravitator is of the order of one million to one in efficiency.

Moreover, in all past-projected space rockets, the weight of the fuel alone was nine-tenths that of the entire ship! In Banshuck's atomic space flyer, it is less than one-hundredth! Furthermore the acceleration at the start of the flight can be gradual, the speed of the flyer increasing immeasurably after it has left the earth's atmosphere behind.

The curious action of *mass ejection* is that the small particles ejected are by no means red hot and incandescent—as is rocket gas. They are pellets about the size of buckshot, EACH PELLET WEIGHING SEVERAL HUNDRED TONS, *but only at the moment of ejection.* Moreover, these pellets are solid for less than one-thousandth of a second. After that their mass disintegrates into nonradioactive radiation.

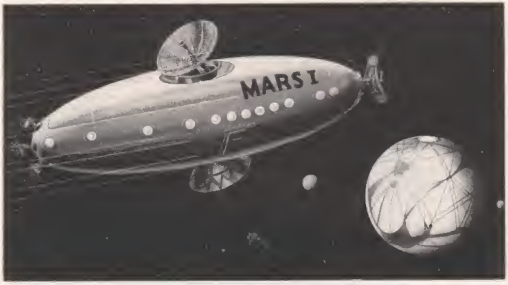
In short, Dr. Banshuck's generator converts energy into *mass* in chain-reaction fashion. In a sense, it is an atomic bomb in reverse! At the same time, it resembles an atomic pile, because, as in the latter, energy can be collected and controlled as wanted.

The Historic Flight to Mars

A number of trial flights were made with the space flyer MARS I early in 1949. The first, extending only into the stratosphere, was made to test the atomic plant and the air-worthiness of the flyer.

The second flight went 200 miles above the earth's surface. The interior of the flyer was pressurized at 6,000 feet above the earth, which was also the pressure maintained on the first interplanetary trip.

The third and last trial flight was at an altitude of 1,100 miles in the vacuum of space at an average outside temperature of 260 degrees below zero. The earth was circumnavigated twice, approximately over the equator. The first circumnavigation at a speed of



Atomic Space Flyer: Uses an entirely new principle—Mass Ejection Propulsion instead of inefficient rocket principle. Atomic generator transforms energy into mass which propels flyer. Note three radar antennas which automatically steer ship to avoid meteorite collisions. At lower right Mars with canal network and its 2 moons: Phobos and Deimos.

4 miles a second (14,400 miles an hour) took 2 hours and 10 minutes. The second trip at 6 miles a second (21,600 miles an hour) took 1 hour and 27 minutes to circle the earth.

The Great Day

Finally on August 22 came the great day of departure. Grego Banshuck had selected for his crew and companions the five well-known physicists Kars Gugenchob, Gus N. Habergock, Oskar C. Henbugg, Grace G. Hucksnob, and Erno Shuckbagg.

The day of departure had no particular astronomical significance. On that date Mars was 170 million miles distant from the earth. This distance would decrease daily till on March 24, 1950, Mars would be in opposition with the earth at 60 million miles—not the closest opposition, which will take place on September 11, 1956, when Mars will be only 35 million miles distant.

The final take-off at 11:15:15 was uneventful and practically noiseless, if compared with a large rocket take-off. Like all previous flights, the final one took place at night to avoid observation by outsiders.

Then the men who remained behind took over to record the historic flight by radio and radar. The powerful desert station could keep in touch by radio communication with the flyer's crew 24 hours a day, and for 14 hours daily by radar (due to the earth's revolution).

Meteoroid Collision

The trip at the maximum speed of 40 miles per second was calculated to take about 49.2 days after leaving the earth.* This was exceeded by only one day, because of a small mishap.

Six days out, a tiny meteoroid, about the size of a pea, collided with MARS I and penetrated the inch-thick metal shell of the space flyer. Traveling at a rate of about 42 miles a second—*a speed far greater than that of any high-power rifle bullet*—the tiny missile damaged a B-reactor of the atomic power plant. The thick rubber layers on the inside of the flyer's shell effectively stopped any air loss until final repairs to the shell were made. But it took almost a day to repair the reactor itself.

An elaborate radar system automatically veers the space ship to prevent meteorite collision; but evidently the meteorite shower was so dense at the time that one small fragment struck the ship.*

Finally on October 9 there was sent the last laconic message out of the recesses of the great void:

"Will land on Mars tomorrow 2 p.m. Mountain Standard Earth time, near *Syrtis Major*."

GREGO BANSHUCK

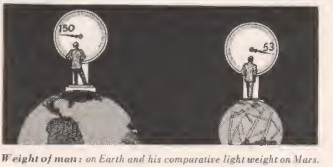
The Landing on Mars

(Dr. Grego Banshuck, first human to set foot on Mars, now personally relates—exclusively for this magazine—his historic experiences on the Red Planet. Due to space limitations, only the highlights are presented here. Full details of the entire exploration trip will be published soon in a special book authored by Banshuck and his five fellow explorers.)

The MARS I touched ground on the fourth planet at 2 p.m. Mountain Standard Earth Time, on October 10, 1949. Yet, 15 hours before landing, we had unmistakably felt the influence of a superior force, which kept increasing as we neared Mars.

All six of us felt simultaneously a sensation almost mind-numbing. We worked as if in a dream—mechanically, more by instinct than consciously. The tele-hypnotic force—for such it proved to be—increased constantly. We could talk to each other only with difficulty, and felt compelled to do things as if controlled by some superior will.

We still steered a course—now at reduced speed—to effect a landing south of the great triangular configuration *Syrtis Major*, shown prominently above the equator on all astronomical maps of Mars. A few hours before landing, however, a clear and unmistakable order filled our consciousness:



Weight of man: on Earth and his comparative light weight on Mars.

* A speed of 40 miles per second in free space is moderate. Meteorites travel up to 45 miles per second before striking the earth's atmosphere.

* Hugo Gernsback, writing in an editorial article, "Radar Possibilities," in RADIO-CRAFT, MAY, 1935, was the first to point out the great possibilities of radar for safeguarding rockets in interplanetary flights.

Hypno-Telepathic Command

"Land your machine on triangular plain near apex Syrtis Major. Do not leave machine till ordered."

This hypno-telepathic command, repeated three times, was recorded by all of us simultaneously.

We steered for the large, red triangular plain as ordered, making an uneventful landing at 2:04:16 p.m.

Through the portholes we noted the brilliant, but now much smaller, sun in a dark-blue, almost black, sky. This we had anticipated, as the atmosphere on Mars is very tenuous and can best be compared with the upper reaches of our own stratosphere. It is so thin that no human being could live in it very long. We noted strange markings on the vermilioned ground, which we could naturally not interpret. We also saw weird flying machines—round, transparent and cheeseboxlike, with no visible means of propulsion.

On the horizon were huge shining structures which seemed to move.

Suddenly five of the flying cheeseboxes descended upon us and surrounded our MARS I. They stationed themselves about 20 feet above our space flyer, forming a complete circle around us. Soon we were told telepathically: "Remain inactive while sanitation process takes place."

Hot Quarantine

Instantly every metal object gave out long electric streamers; nonmetal objects—our bodies included—glowed with an unearthly, vivid green luminiference that burned and itched. Our whole insides tingled intolerably. Our temperatures were soon at a high fever—we were burning up. All of us lost consciousness. How long we remained in that state, and what happened while we were unconscious, none of us knows.

Cholos Indian

However, we awoke with a start, entirely normal again and imbued with an extraordinary sense of well-being. We were soon told that we could now leave our machine.

We equipped ourselves with our plastic, airtight, spherical helmets, strapped on our oxygen back tanks, put on warm suits, and unbolted the sealed door of our flyer in which we had lived for the past fifty days.

We stepped out carefully and gingerly, insecure with our now greatly lightened bodies. On earth our average weight per person was 150 lbs.; on Mars—due to its greatly reduced gravitation—we weighed only about 53 lbs. now.

Immediately we felt the cold in the thin air and knew that the afternoon Martian temperature was far below freezing.

But we had not been prepared for the sight of the Martians themselves, three of whom now rapidly strode over to us.

No one could have imagined the grotesque appearance of this race.

Behold the Martians

Almost 10 feet tall, their huge barrel-shaped upper bodies were surmounted by a tremendously ponderous head, shell-like ears almost a foot across, and—most surprising of all—an elephantine nose 3 feet long. Yet most impressive of all were the stalk-eyes which projected out of their heads and could telescope in or out. The huge eyes themselves were hypnotic in the extreme to us—we could never avoid their compelling gaze.

From the top of the head sprang two huge insect-like antennas—the telepathic organs. The mouth was like a flattened beak.

The entire body was covered by a wool-like growth for warmth. The arms and legs appeared thin and fragile. There were eight fingers on each hand, while their feet were huge webbed pads.

Later we understood the strange Martian physiques better. The race is very old—with over 2 billion years of evolution behind it. Due to the poor gravitational force of Mars, its atmosphere never had been dense. To survive, the Martians had to develop huge lungs; hence the enormous chest, dominating the entire body.

(On earth the Cholos Indians, living at an altitude of 12,000 feet in the Andes of Peru, have developed chests much larger than those of other humans. —*Editor*)

The huge ears were evolved because the thin Martian air conducts sound very poorly. Scents and odors, also travel poorly in the attenuated atmosphere, hence the long, elephantine nose *which must go to the odor*, rather than have the odor go to it.

As arms and legs have performed little physical work for over a billion and a half years, they have gradually atrophied, becoming thinner and thinner. The huge feet are necessary due to Mars' inferior gravitation. It would be difficult for the 10-foot Martians to walk with small feet—the large pads give them a secure footing. The low gravitation also accounts for the great bodily height of the Martians.

The stalklike, mobile eyes make for superior focusing and excellent eye accommodation. Martians need no glasses; indeed the telescoping eyes act like two precision bellows cameras.

Telepathic Antennas

Most interesting of all are the telepathic antennas. They appeared first about a billion years ago, when the brain had already enlarged to twice the size of the prehistoric Martian's. The present-day Martian has a colossal brain which in volume is about 9½ times that of the human.

By now the three Martians had advanced up to us and stood eyeing us as if we were some newly arrived puppies. There seemed to be a good-natured smile on their superintelligent countenances, but no surprise or curiosity whatsoever.

That they seemed to know all about our thoughts, and indeed all about us as well as our plans, became quickly apparent. The leader, a majestic figure, and compelling in the extreme, was distinguished physically solely by a wide sort of armband on his upper arm. It had a number of scintillating spots which changed continuously in color in a strange rhythm. His two companions stood a little to one side and were rapidly working some hand instruments attached to the wrist (thought-recorders—we found out later).

The leader now addressed us telepathically. While he talked, his antennas waved from side to side constantly. From time to time he moved his

PHOTO FLAGSTAFF OBSERVATORY, FLAGSTAFF, ARIZ.

Mars Canals: Mars, the fourth planet is much smaller than the Earth. The latter is 7918 miles in diameter, Mars only 4218 miles. Above we see one side of the Martian sphere, criss-crossed in all directions by the vast network of canals. These canals are real—*they have been photographed repeatedly*. The above picture was made when Mars was 47 million miles distant from the earth. It never comes closer than 35 million miles. Note the two ice caps at top and bottom, *the top is south, the bottom north* (as seen through telescope). As the ice of polar cap melts (see page 11), the waters flow into the canals equatorward. Some of the canals are over 3500 miles long. All canals are geometrically straight. They run right through the dark areas which indicate land with vegetation. Note black dots where canals meet at junctions.

head slightly for emphasis. The stalk eyes fixedly gazed at my own.

Electronic Disinfection

As "secretary" of the Mars Government he briefly welcomed us, stating that our coming was well known long before we left the Earth. He stated that the Health Authority required our brief quarantine detention in our space flyer, in order to exterminate electronically all disease-bearing bacteria and infection carriers.

He went on to say that he would communicate Martian thoughts to us in such a manner that we could understand, as far as this was possible, their civilization, their customs, and their mode of life. He warned us that we would be able to understand only very little and that most of what we saw would be forever unintelligible to us, due to the great evolutionary gulf that separates us.

He would be our steady companion for our entire stay on Mars and would try to answer all our questions, as far as he was able.

Flying Cheeseboxes

As he finished talking, one of the flying, round cheeseboxes settled down near us. Perfectly circular, it was completely transparent except for the center portion. About 40 feet in diameter and 15 feet thick, it had only two slight projections and no visible propellers or engine. As we approached the flying box, a round doorlike opening materialized in the side and we all walked in. Transparent seating arrangements were set all around the inside curved wall. The individual seats could swivel around completely so one could look out over the countryside. In addition, the seats automatically hugged your body as soon as you sat down.

In the center of the machine there was a small 5-foot black object, obviously the engine that drove the flyer. Several questions to our leader confirmed this.

"Machine flies by neutro-gravitation," was the laconic answer. "Engine neutralizes gravity of ship, which then rises by invisible electromagnetic repeller of wavebeam. By changing angle of beam, ship travels in any horizontal direction."

"Who runs it?" was our next question. "I do," was the surprising answer, "by telepathic impulses! I merely concentrate my attention on the telepathoamplifier which translates the impulses to steering device. Machine does the rest."

We all looked amazed. More and more we began to feel like six not-too-intelligent puppies set down in the control room of the Palomar Observatory, trying to investigate the mysteries of the 200-inch telescope!

The Earthlings—Our Arrival Causes No Stir

During our rapid trip to our quarters, we learned

Cosmotronic Microtelesonator Operator

from our host that our landing on Mars had been anticipated ever since our first test flight of MARS I. It must be remembered that a civilization over 2 billion years old is so much more advanced than ours, that little which occurs on Earth—or for that matter anywhere in the universe—is hidden from the Martian supertechnicians and scientists.

Their instrumentation has reached such advanced stages, such perfection and refinement, that I will give only a few examples to show what they have achieved in several spheres.

Their *cosmotronic* ultra-telescope can pick up any spot on earth and photograph it. I was shown *cosmographs*—faultless pictures of King Solomon, Moses on Mount Sinai, Cleopatra, Alexander the Great, and President Truman —*all shots taken directly from Mars.*

Their cosmotronic microtelesonators can pick up with a radarlike machine actual sounds from any spot on Earth and make a noise-free recording. As cosmic waves penetrate steel and granite for many miles, they have little difficulty in penetrating into our homes and skyscrapers, recording sound and sight. Later I was to see actual duplicates of one of our latest motion pictures taken directly from Mars as the picture was unreeled at Radio City Music Hall in New York City! Such pictures (called cosmographs) of people walking on Earth cannot, of course, be made when Mars is directly overhead. The Martians take their pictures when the spot they wish to cosmophotograph is in *direct line* with their cosmo-cameras. This is easy to do as the two planets revolve on their axes. Hence, the Martians wait until the angle between the two planets is at an optimum. This also means that they may have to "shoot" their pictures through doz-

ens of city blocks—often even hundreds of miles through a section of the earth (and perhaps through Mars). They have even taken cosmographs of complete newspapers while they were being printed!

From all this it must be realized that the Martian Intelligence Department is well posted on all important happenings on Earth. Thus, for instance, every step taken in our atomic-bomb development was immediately known on Mars!

Why Martians Don't Visit Earth

One of our first questions naturally was: "Why don't you visit our earth?"

"We have—innumerable times!" was the not-too-surprising answer. "We first explored your planet over 475 million earth years ago, in your so-called Paleozoic era. We collected many of your fauna and flora. Your minerals were of no interest as Mars has identical ones. Many other trips were made in successive ages, but we found the procedure boring because your planet evolved in nearly the same manner as ours.

"Things became more interesting when man appeared, but, here too, human evolution was somewhat parallel to ours. For over 60,000 years now we have refrained from actually setting a foot on Earth as we had done in former ages. There is no valid reason for personal visits; but when we do make occasional tours, for special purposes, we never descend below the outer reaches of your ionosphere, i.e., 200 to 250 miles above the Earth. At that height you cannot see our nearly invisible space trajectors. There are three vital reasons why we do not wish to land on your Earth.

"First there is germinal danger for us. Trips to the surface in past ages have been uniformly expensive to us in explorers killed, due to contraction of virulent diseases which could not be counteracted quickly enough by members of our expeditions.

"Secondly, on Mars our average weight is 95 Earth-pounds. On Earth it is 270—too much for our frail legs to support. Worst of all, your planet's superior gravitational pull tends to make our large brains far too heavy for comfort—it paralyzes us! We compensate for this condition in our space trajectors; and, if it were ever necessary for us to walk the Earth, we could do so with gravitation repellers strapped to our backs. These devices, however, are bulky and make us skip and hop in an undignified manner. Then, too, we cannot live in your dense air. It gags and chokes us and makes our hearts race because of its high oxygen content.

"Worse than this your thick atmosphere deprives us of most of our customary sun's ultraviolet radiation which we get on Mars. To live we must have abundant ultraviolet rays.

"Besides there is no good reason why we ever should descend to Earth. You have nothing to offer us; we have all the Earth information we need, so why should we trouble ourselves needlessly?

What Happened to Planet V?

"Lastly," said the great Martian, "humans *en masse* are worse than your wild animals. You are still far too low in the evolutionary scale to suit us. The human race is wholly too rapacious, too unscrupulous to trust. If you learned too much of our science and of our present accomplishments, you would most likely use the knowledge for further deviltry and warfare, which latter is obnoxious to us. In the end you would even try to make war on us, and we then would have to exterminate *you*.

"This is exactly what happened when 326 million years ago we foolishly befriended the greedy race of the fifth planet. They had learned most of our science and for two million years tried to invade Mars—the last time almost successfully! So we blew up their beautiful planet—about the size of your Earth, with three moons—with our then newly discovered *cosmatomics*. Today only billions of particles of this vanished world remain, gravitating in the orbit of the former planet between Mars and Jupiter. Your astronomers call this gravitating debris *asteroids*."

OPINIONS from MARS COLUMNISTS

(Note. *There are no columnists on Mars, because newspapers do not exist on the fourth planet. News is disseminated by TELEPATHOCASTS. As Martians do not speak, but make only birdlike musical sounds, all famous newscasters are known by three distinctive musical notes.)*

DO-RE-MI: "Those pathetic little earth children have finally arrived in their tin wagon. Do not let us repeat the historic, bungling mistake we committed with the race of the fifth planet! Let the representatives of the vicious, war-ridden human race see and learn only what is good for their *peaceful* progress. We must keep from them everything that they could use for destruction."

SOL-FA-LA: "It must have been a terrible shock to these vain Earth kittens that we knew all about their plans and their coming. Now that their race has discovered atomic energy, let's be interested spectators and watch the gory humans exterminate each other in earnest!"

DO-SI-MI: "In the Earth race we have the best example of evolution with a curse. All the meanness, all the selfishness, all the destructiveness, all the misplaced vanity, are distilled into it from its worst forebears, crowding out all the noble and the good instincts. Of all the races in the universe, the Earth race occupies the bottom rung."

SOL-FA-DO: "I too agree with our High-Control that it was wise to admit the six humans, purely as an experimental venture. If we can demonstrate to them with our own example that every thinking race has only ONE enemy—*Inexorable Nature*—then perhaps there is hope for the humans. Yet, knowing their terrible past record, I hold no illusions. They fight each other rather than fight Nature, but Nature always bests them in the end."

MI-SOL-SI: "The Earthlings have the rat's instincts. Nothing we can do will change that. Let us beware of them and keep all further Earthlings *out*, lest we come to regret it."

Mystery of Mars' Canals Explained

As we were speeding rapidly over the countryside, we noticed great arrays of fantastic structures—huge transparent pipes supported by high skeleton towers. They looked like monstrous aquaducts, but we were told that they were a planet-wide system of cosmic energy collectors and transformators. What looks like a single pipe from a distance, actually are two, one within the other. The inner pipe contains a thermic-radioactive liquid which keeps the temperature of the outer at a constant temperature level. The outer and larger pipe contains a vegetative type of thick liquid. Solar heat and its chemical rays and filtered cosmic radiation cause the constant and rapid growth of a highly specialized micro-plant life. After conversion at subterranean chemical plants, it is processed into proteins, carbohydrates (sugars, starches, etc.), and other foods. A high percentage of all Martian food is thus "grown" efficiently.

The countryside abounded with many other huge energy-sunplants of fantastic design. There were titanic, revolving, parabolic-lens mirrors to catch the

Blast-Fused Canals: By means of huge articulated machines, as large as ocean liners, Martian scientist - engineers disintegrate sands, rock and dirt atomically. Huge 1000-foot latticed booms sweep atomic "head" in semi-circles as machine "walks" forward at 3-4 miles an hour. Canals are 20 feet deep—½ to 5 miles wide, run over 3300 miles long.

sun's heat and rays. The mirrors follow the sun in its course throughout the Martian day (there are no clouds due to the extremely thin atmosphere).

Then there were skyscraper structures, shaped like an enormously tall book. They also revolved, always presenting their flat transparent sides to the sun.

We also saw curiously shaped towers spaced in geometrical patterns all over the land. At the top of the towers were arrays of porcupine-appearing rods. These were *sand-storm dissipators.*

The surface of Mars is largely desert, the sand of these deserts being an incredibly fine dust. As practically no rain ever falls on Mars, the desert dust is a major problem to the Martians. Even a light wind raises huge clouds of it. Therefore, the Martians built these dissipator towers, which by a combination of electric, cosmic, and atomic energy "lay" the sand dust that is always present and prevent it from swirling. By energizing certain towers they succeed, not only in stopping even big dust storms, but returning them to their point of origin.

Passing over a number of great Martian canals, we were naturally eager to understand their real purpose. Professor Percival Lowell, famed American astronomer, had been partly correct in evaluating their *raison d'être.* They were indeed irrigation waterways to provide water for the parched and water-poor planet which has no oceans of any kind. To distribute the necessary water over the entire land surface, the Martians, by means of atomic energy, *blast-fused* the so-called canals which are never deeper than 20 feet. By using atomic heat projectors,* the desert sands are fused into a homogeneous mass, down to a depth of 20 feet. *Hence the waterways are completely lined with a thick glasslike mass,* which allows no seepage of the precious fluid.

The canals themselves criss-cross the entire planet in geometrically straight lines and run from one pole to the other. The width of the canals varies from ½ mile to 5 miles. Each waterway is tapped at numerous points along its route with lateral irrigation canals leading to various plantations.

Plant life, however, is not used extensively for food purposes by the Martians, as we already have seen. Even fruit trees account for only an exceedingly small percentage of the total plant life. The purpose of the canals is two-fold. First they are used for irrigation to create fast-growing, tough, large-leafed plants. Plant life, as every schoolboy knows, helps to maintain the oxygen balance in the atmosphere by the decomposition of carbon dioxide. It does so on Mars too. The dense plant growth paralleling the canals for from 20 to 60 miles is also a most effective barrier for the eternal, distressing dust.

Second, there being no railroads or surface roads on Mars to speak of—due mainly to the ever-shifting desert sands and dust—the big waterways are used extensively for all heavy freight traffic. All other traffic goes through air.

What Makes the Waters Flow?

The greatest puzzle of the Martian canals for humans always has been: How is the water made to flow in them? The surface of Mars is perfectly flat, there are no mountains of any kind. Yet the water flows in the canals from the north pole right over the bulging equator during the spring and summer thaws. The flow is reversed from the south pole during next season toward the north pole. (Mars, like the Earth, is a flattened spheroid; the poles are 21 miles lower than the rest of the globe, according to the late Professor Percival Lowell.)

Yet all of us know that water cannot flow uphill from the north pole, up over the equator, and down toward the south pole.

The Martians do not use mechanical means to move the waters—although they could do so if there were no other means. The problem was solved in a much simpler manner. Furthermore, Professor Lowell erred in thinking that enough water could be evaporated on Mars by the sun and be condensed in the atmosphere, finally to be returned to the two poles in the form of snow.

The trouble with this theory is that there is only a pitifully small amount of surface water on Mars. Furthermore the atmosphere is far too thin now to form clouds, and has been in that state for nearly 900,000 years. Consequently only a small amount of water vapor is condensed nowadays and exceedingly little snow falls on the poles.

The Martians, threatened with extinction, perforce had to take heroic means to survive. This they

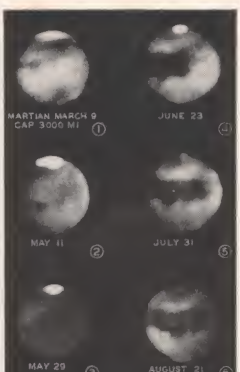
* This atomic method of constructing the Martian canals was first suggested by Hugo Gernsback in his novel *Baron Münchausen's New Scientific Adventures,* published in the *Electrical Experimenter,* November, 1916, page 515—26 years *before* the advent of atomic energy.

accomplished almost a billion years ago when the titanic waterways were first considered.

The plan was as breathtaking in its audacity as it was grandiose.

The problem resolves itself into four parts:

1. Nearly a billion years ago Mars had two polar ice caps, as we have on earth today. Century after century these became smaller as the then-forming deserts absorbed the waters, never to return them. It was decided to build a ring of atomic, artificial water generators at both poles. For raw material the Martians have an almost inexhaustible supply of desert sand. This is transmuted atomically into water at the poles; the hot water is then conducted into huge artificial lakes where it freezes solid during the arctic nights. Titanic artificial moats surround the poles. These moats—built with atomic blast-fusing machines—are waterproof; hence, no precious water is lost. All the canals end in these polar moats.



Mars Ice Caps: Polar ice melting in spring and summer. 3000 mile cap reduced to 150 miles in 3½ months. The melting ice fills canals with water. Photos by *Flagstaff Observatory*, Flagstaff, Ariz.

A Brilliant Solution

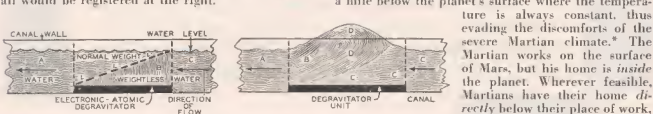
2. When the spring thaw comes, the canal terminals rapidly fill up with their life-bearing water. *But the canals have no slope*: it cannot flow. Worse yet, *the Martian poles are depressed* 21 *miles*. Hence, *the waters actually must run uphill* to start their journey. We shall see how brilliantly this problem was solved.

3. To bring the essential water to the distant cities and industrial plants, the canals were built in less than two Martian centuries (400 Earth years), entirely by the atomic blast-fusing process. To understand the immensity of the project, one must realize that some of these huge waterways are over 3,300 miles long, and over 5 miles wide.

4. But the canals themselves would be useless unless water flowed in them constantly. And it does so at the rate of 51 miles a day, or 2.1 miles an hour, according to accurate measurements made by Professor Lowell, at Flagstaff Observatory.

Here the Martian engineers stepped in with electronic-atomic means. Every 2,200 yards there is built in at the bottom of the canal an *atomo-electronic degravitator*. The latter device is only 1 foot thick but runs entirely across the canal. It is usually about 10 feet wide (see cut).

Near the pole, the water starts flowing down a decline, setting it in motion. About 2,200 yards down the canal, the water moving at the rate of 2.1 miles an hour hits the first degravitator. This is now energized for a few seconds. During this short time, the water becomes weightless in a varying degree as shown by broken lines L—more weight at the left; no weight at all would be registered at the right.



The effect on the flowing water C is as if the weightless body of water at B did not exist. C therefore pushes B out of the way. This now forms a wave at D in the second figure. In the meanwhile water A has moved on. Now wave D collapses—as the degravitator has ceased to operate. It mingles with the lower-level water A. Its full weight returned, it helps to push A on its way. In this it is helped by water C, which acts as if it had been sucked into a vacuum when D was lifted out to form a wave.

Stripped of all technicality, the water degravitator acts as your hand does when you impart a swirling rotary motion to the water in a basin.

The amount of power used in one degravitator is relatively small. All the degravitators spaced along the canal must work in unison to move the water.

The advantage of the degravitation propulsion of water is mainly that there are no moving parts, no machinery. This method also makes it simple to reverse the waterflow next season to the other pole.

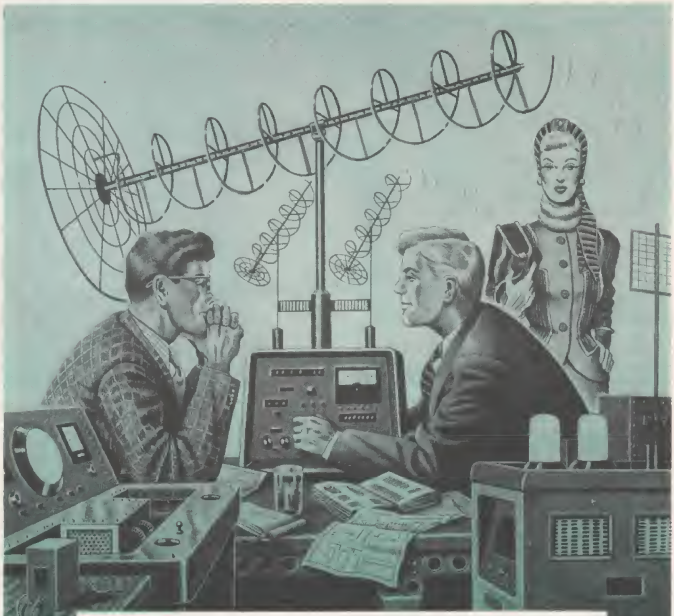
Martian Housing—Underground Cities of Mars

Our transparent flyer came smoothly to a stop in a small round plaza on which we saw ten or more similar transparent flyers either landing or taking off. Each landed or departed from a colored, round marker exactly the size of the flyer's circular base. Alighting, we immediately found ourselves on a moving strip which rapidly carried us to a large, circular opening in the center of the plaza.

Martians, we were told, have their homes nearly a mile below the planet's surface where the temperature is always constant, thus evading the discomforts of the severe Martian climate.* The Martian works on the surface of Mars, but his home is *inside* the planet. Wherever feasible, Martians have their home *directly* below their place of work, or nearly so. *The State frowns upon all horizontal travel to and from work.* Thus, the Martian office or factory worker merely takes a constantly moving express platform down to his home—or up next morning—the trip never lasting more that a few minutes. *There are no traffic problems on Mars.*

(*Continued on page* 61)

* At the equator the maximum daily temperature may be about 50°, falling to 40° or 50° below zero at night, according to Prof. Donald H. Menzel, of Harvard College Observatory.—Editor.



Man strives constantly for happiness. Sometimes he moves forward three steps and slides back two, but he never stops trying. Utopia is the goal of civilization—the dream of all mankind! Many great minds—among them Edward Bellamy, Samuel Butler, H. G. Wells, and Thomas More—have written their versions of Utopia. John Scott Campbell, scientist and writer, offers here his picture of Utopia. Ease and plenty for all. The Golden Rule, the unwritten law of the land. No barriers of race, color, or creed. But is it Utopia?

JOHN SCOTT CAMPBELL

Mr. Campbell is a member of the faculty of The California Institute of Technology. He has been writing science-fiction for diversion since 1929, when he sold his first story, *The Infinite Brain*, to Hugo Gernsback. During the last war he was Project Administrator at Lockheed Aircraft. His specialties are electrical and mechanical engineering and engineering drafting. He is at present working on two technical engineering books.

VIDOLA

5F

by JOHN SCOTT CAMPBELL

(Illustrations by Tom O'Reilly)

"I'm Marilyn Mills," she began without entering the door. "Howard Sipple's friend. Something terrible has happened and I thought that you might help . . ."

I interrupted to invite her in. As she sat on the sofa, she drew her feet up under her in a manner suggestive of an animal settling down. She paused a moment to gather her thoughts, and then began:

"You remember in May I came to ask advice on a wide-band amplifier for use in certain biological experiments?"

I blinked in surprise. "Why, I don't believe so . . . Dr. Dunn dropped in with a question about amplifiers, but . . ."

I had never seen the girl before, although Howard had spoken to me of her. She was good looking, but she appeared distraught.

"I'm sorry. I keep using the wrong words. *Dr. Dunn* came to see you. And you recommended that Howard build the co-ordinator for him. An excellent choice. He completed the machine and we have used it for a week. It has co-ordinated Dunn, Howard and me. You understand what I mean?"

"I'm afraid not."

"Well, the co-ordinator is an amplifier and re-radiator of certain very high frequency oscillations which take place in resonant structures in the brain. It induces oscillations in similar parts of other brains within range, and so duplicates thought patterns. The effect is one of exceedingly powerful telepathy, amounting to a merging of personalities."

She paused. My face apparently mirrored my amazement, for she guessed my confusion and smiled for the first time. "Then Howard hasn't told you about it?"

"I haven't seen Howard in a month. But . . ." I tried to express my astonishment. I was in fact less surprised at what she said than at her casual use of such technical expressions!

"I'll tell you all about it in a moment. But, for the present keep this much in mind: you are not talking only to Marilyn Mills. You are talking to a combination—we call it a combo—of three people, Marilyn Mills, Howard Sipple, and Dr. Robert Dunn—and Bozo, Dunn's pet boxer. We are all the same, except for Bozo, in terms of memory, technical skills, attitudes and beliefs. We are merged! Dunn's co-ordinator is, I assure you, the greatest discovery ever made. It is the means of accomplishing the dreams of humanity since Utopia was first thought of. It unites men's desires and ambitions, eliminates disagreement and conflict. It will end hate, persecution, and war.

"I became a member quite by accident. I entered the range of the integrator in Dunn's lab one night, when I went there to meet Howard. Thought transmission is really thrilling, Professor . . . thrilling."

She stopped abruptly and looked at me. I did not reply at once. I tried to digest this remarkable statement, but even more I tried to identify the elements of personality that made it. It was clearly not the original idea of the usual eighteen-year-old girl. I detected the naïve exasperation of the man of science, inexperienced at world affairs. I had felt that way myself, some years ago, when several atomic scientists tried to influence politics. And I also detected the angry protest of idealistic youth against the turmoil and uncertainty of our age.

"I think I get the general idea," I told her. "Now, what has happened?"

"Dr. Dunn has been kidnaped."

"Kidnaped?" I had expected that the troubles were between her and Howard, or were in some way a consequence of the weird experiment. "But, by whom, for Heaven's sake? Maybe it's some joke."

She shook her head. "It's no joke. I saw the men, that is, Bozo saw them and managed to transmit a fair picture to me later. They're total strangers—apparently outsiders who read in the *Sentinel* about the machine. We should have had the sense to keep quiet. We should have taken in somebody who knew more about the world. Here we are—a college professor, his novice assistant, and me. What a combination of people to own the secret of the ages!"

I tried to get her back on the track. "But, what could be the motive? Don't you know anything about them?"

"I believe they are what the papers call bunko artists. Confidence men who sell phony stocks to unsuspecting buyers. Cheap grifters. They read that we had developed a hypnosis machine which they figured would be useful in their business. So they did the natural thing: kidnaped Dunn and stole the portable model which Howard just finished."

"That is serious. They might kill him. Have you notified the police?"

She shook her head. "That's the last thing to do. No, they won't hurt him. But something even worse may happen. They took Dunn because they did not know how to operate the machine. So what will they do first thing? Plug it in and order him to give a demonstration."

"Where is Howard?" I asked.

"In the lab, finishing up another portable co-ordinator. We're going to find them, but we'll need expert help. And why argue with the police when there is a much better way?" She looked at me, and I shook my head with determination.

"You don't want me. I'm just another college professor. What you need is a composite of Sherlock Holmes, Abraham Lincoln, Socrates . . ."

"They're all dead," said Marilyn, disgustedly. "Name a few who are still alive."

"Now look, Miss Mills. Don't you two start indiscriminately kidnaping people, too."

"But that *is* our plan. We need more brains and experience in our combo, so we arranged for a demonstration in Washington. Why, there was a chance of getting the joint chiefs of staff all at once. And then

this happened. Perhaps they have killed him."

It was too much for me. "With that sort of power," I said, "you don't have to worry. Dunn will no doubt come back dragging two reformed confidencemen behind him." My fingertips felt cold with the horror of the idea. "No, Miss Mills," I said with studied determination. "I cannot help you. And I think you need to worry only about the danger of your machine."

I hurried her out of the door, for I dreaded to connect myself with such an unknown quantity. Much relieved by my solitude, I settled down to work again. Thoughts of Dunn and the girl ran steadily in my mind.

I recollect Dr. Dunn, in the pleasant warm spring days, as an amiable, somewhat preoccupied little man of fifty. He was a research associate in biochemistry. As my field is electronics, I had little contact with him. In fact, when he first called one day in March, I could not remember his name. He had a problem in electronic circuit design, but he knew so little about the subject that he could hardly describe what he really wanted. At least, I think it was ignorance and not a desire for secrecy that made him so vague.

Dr. Dunn apparently wanted an extremely wide-band radio-frequency amplifier. When I had given him the technical terms, he blandly asked for uniform response from zero to thirty thousand megacycles. I informed him that no such thing had ever been achieved with a single amplifier and suggested that he review his requirements to see whether they could be reduced without impairing the experiment. He went away, considerably disappointed, promising to study the question. I returned to my laboratory convinced that I had seen the last of the biologist.

But he came back exactly four days later. He had greatly reduced the frequency range, although it was somewhat complicated by a requirement of small phase shift. I told him that this design was feasible and that Howard Sipple, a graduate student in electronics, could construct it for him. He did, in fact, help the Doctor. He told me a little about the project one day in July.

The Doctor was working on brain waves!

I asked Howard why he needed an amplifier with a wide range when brain waves were around four or five cycles per second.

"Those are just power-supply waves," Howard had explained. "They don't represent thought—just the demands made by thinking processes upon the electro-chemical balance in the brain. According to Dr. Dunn, chains of nerve cells in the brain not only transmit direct impulses, they also act as oscillators—tiny radio transmitters which broadcast complex waves depending upon the thought pattern. These signals of course are very weak, but when they are amplified, they are capable, under the right conditions, of exciting corresponding parts of another brain."

From that July day until August 27, I was increasingly busy with my magnetic research and heard only casual gossip about Dunn. My work required complete shielding from all electromagnetic fields. The whole laboratory was surrounded by two shields of sheet copper and a magnetic screen of mu-metal. Not even pipe or wire pierced the shield, as power for the apparatus came from storage batteries within the room. Since many of the experiments involved electrical isolation for periods of 36 to 48 hours, I virtually set up housekeeping, with food and cot, and lived with my equipment. Therefore I was quite out of touch with the events of the world. The actual progress of the so-called *combo* I learned primarily from Bozo, Dunn's boxer. By chance he was absorbed into the combination. His understanding was limited, but in areas which he could understand, he became literate. He could not speak, but he understood several thousand concrete nouns and verbs. He could read these, too. He also understood much elementary electronics and biology, but with many gaps in theory. Several months after my interview with Miss Mills, Bozo began to describe his feelings to me, spelling out words with a pencil tied to one paw.

HERE is the story as I have reconstructed it from sundry sources.

Now, Dr. Dunn had been kidnaped. The crooks, who were hoping to use the co-ordinator for their own purposes transported the Professor to their hideout in typical melodramatic style, then ordered him to show them how the machine worked. Dunn fired it up willingly, certain that he could subdue the men by mental concentration. As soon as the co-ordinator began to broadcast, all three men awoke to the Nirvana of understanding and agreement. The kidnapers marveled over the magnitude of his plans for humanity and promptly forgot their own petty schemes. Dunn, on the other hand, discovered in these shrewd and experienced men a practical balance for his idealism. The con-men's natural mistrust of authority permeated the combo. The plan for a demonstration of the co-ordinator was therefore abandoned in favor of a series of clandestine coups!

Dunn and his two new partners held a long mental council of war before they ventured from the hideout. The basic plan of action was simple: to envelop the world leaders surreptitiously in the radiation field from the co-ordinator. It was plain, of course, that it was not just a matter of walking up to Stalin, or some other guarded leader, and turning a switch. They would first have to make preliminary contacts, with men who could arrange such a meeting. They realized, of course, that each new member provided new attitudes, but they felt it unlikely that the basic plan was in jeopardy.

After several hours of thought, the members of the combo started off. They withdrew a few thousand dollars from Dunn's savings account, and bought railroad tickets for Washington. They engaged a drawing room, and there they turned on the co-ordinator for another conference.

The moment the broadcasting began, however, a new sensation interfered with the first interchange of thoughts. The three men sensed a new element. A fourth human being was within the radius of the machine, a human who had been sleeping but whose mind was now being aroused by the flood of strange thoughts. The combo was not apprehensive about the interloper as they would have been a moment before; as usual, sensing a new personality was exquisitely pleasant, especially in this case, because of the slow awakening of the new mind. As consciousness unfolded, the combo could picture the adjoining compartment, and feel an easy-going literal personality, confined in experience primarily to material pleasures, and whose occupation was making beds in pullman cars and serving passengers.

It was the pullman porter.

Upon its arrival in Washington, the combo made no progress, in fact they bungled badly at the start.

But the great power they wielded could absorb any number of blunders. Like dislodging a stone to start an avalanche, it required mere stumbling around to precipitate the world.

They first attempted to secure hotel rooms together, but the dark color of the porter barred this, so, without further delay they checked their luggage at Union Station and walked toward the Capitol where Congress was in session.

On the tree-lined avenue leading to the seat of Government, large and small groups of sightseers wandered among the usual pedestrians. Taking turns carrying the heavy co-ordinator, the foursome mingled with them. Nevertheless they excited much attention among the spectators. Laboriously they climbed the marble steps and entered the rotunda. A milling crowd gaped at the dome and the great historical paintings, and waited for the guided tours of the building. It was at once obviously impossible to plug in the co-ordinator and capture a senator. In fact, the guards viewed the bulky suitcase with suspicion. If they were to seize the machine the whole venture would end!

The combo was about to leave the building when Jones, the porter, remembered that an acquaintance of his, a former porter, now worked in the House washroom, where he also shined the shoes of the representatives. He quickly whispered to the others (since telepathic communication existed only while the integrator was transmitting) and they hurried as unobtrusively as possible through Statuary Hall, down the corridor to the House wing. Here, after a few wrong turns, the conspirators found the hall behind the House Chamber and ducked into the washroom.

They were very fortunate. No lawmakers were there. Only Jones' friend was there, sitting in the shoeshine chair, reading a newspaper. At the sound of footsteps, he scrambled to his feet in a hurry.

"I'm sorry, gentlemen, but the public is not allowed in here. This room is for . . ." He paused at the sight of Jones.

"Remember me, Horatio?" inquired Jones.

Horatio remembered, but he also remembered his duty.

"Hiyah, Sam, but we can't visit in here. You and your friends will have to . . . Here, now, what you doin' over there?" His eye had caught Dunn in the act of plugging the integrator into a wall outlet. He made two steps toward Dunn, but suddenly stopped, cured forever of the desire to restrain other people. Dunn straightened after checking plate voltage, and the combo proceeded to absorb its seventh member.

The successful integration of Jones assured them that their purposes would not be deviated by the addition of the House washroom attendant. Jones' easy-going mind contributed little, save a sense of physical enjoyment and a pleasant, primitive trust in Lady Luck.

Now Horatio stood rooted to the spot, taking in the flow of thoughts with a happy grin on his face.

With the co-ordinator humming, the combo waited like a spider for its prey. Almost twenty minutes elapsed before the first victim came. The field evidently did not quite extend to the washroom door, for a congressman entered the room and had time to register brief surprise at the reception committee. He was caught when the question forming on his lips was answered more fully and adequately than he could expect.

The impact of the congressman upon the combo was much more severe than that provided by the other converts. Dunn and his associates received a most stunning impression of problems and arguments and compromises, along with a welter of human faces, many filled with greed or supplication. A door was suddenly opened upon a world of complex strife, unresolved difficulties, a world in which tempers were held by conscious effort, and every act had to be measured in terms of its effect upon many divergent forces. It was not a pleasant world and it even shocked the experienced con-men.

The congressman stared at the others while his brain whirled. His mind was trained for quick perception and analysis, and he absorbed the others' thoughts at a remarkable speed, even considering the aid of the co-ordinator. He had been debating on foreign policy, and he obediently fitted Dunn's plan into his own matrix of ideas. Yes, his mind said, it can and must be done, but we will have to be very careful. First we must get the support of our own executive branch. I'm only a junior member of the House, however, and I'd have trouble getting an appointment for interviews with the right people, but I can ask Representative McKenzie, the minority leader, to help with that."

With this in mind, the congressman hurried to the lobby and spoke briefly to one of the pages. In a moment a grey-haired man came out of the Chamber. The younger man took him by the arm and spoke to him earnestly. McKenzie hesitated, but finally came along. As the washroom door opened, Dunn heard McKenzie's voice: "I know, Jack, but I can't decide at once. You've got to learn . . ."

And he was in the field!

Representative Duncan McKenzie proved to be

". . . *Laboratory . . . surrounded by . . . mu-metal.*"

a powerful addition to the combo. His view, wider than that of the younger congressman, was not cluttered with detail. Seen through his eyes, lawmaking was not just a confusion of petty squabbles and patronage; a broad scheme with steady purpose emerged from the conflict. McKenzie agreed to the outline of the combo's plan, but he pointed out something which the others had completely missed.

Utopia could not be attained by the world's leaders. These men, though nominally in control, were actually lieutenants of a powerful force—the temper of their people. No dictator's propaganda machine could alter the basic nature of the people. And, McKenzie emphasized, the changes proposed by the Plan constituted an excursion far beyond anything that even a dictator could accomplish. People do not lend themselves to change, even for the better. In history, many benevolent tyrants gave the people more than they could assimilate. The story of Count Strensee in eighteenth-century Denmark flitted through McKenzie's mind. No, the idea of converting the Security Council to end the world's woes was naive and impracticable.

McKENZIE proposed a different course of action, so bold and direct that it won the instant agreement of the rest of the combo. They decided to enlist the aid of executives in both government and business, for the purpose of building thousands of powerful integrators. Then they would flood the whole world with telepathic radiation and bring into unity, not just the leaders, but all of humanity.

In twenty minutes McKenzie's idea was fully developed. Meanwhile, three other people inadvertently entered the washroom and were ingested by the combo: two other congressmen and a page boy.

And so it was an hour since Dunn and his three companions had excited the suspicions of the guards in the Rotunda. When the little procession of ten crossed through that same chamber, the guards were more than ever mystified. But this time they did not consider interfering, for leading the group was the magnificent figure, Minority Leader Duncan McKenzie.

Events in the next few days occurred on an ever-accelerating schedule. McKenzie arranged conferences with key Government officials in Washington and made flying trips with several integrators to New York, London, Paris, and Rome. The combo grew in strength and experience; we now know it did not grow in true wisdom. Its development was lateral, not vertical. Its skill and knowledge were the sum of the life experiences of many of the world's most brilliant men, but its intuition and insight could not surpass that of the wisest member. Even here, at what was probably the combo's golden period, there were signs of degeneration. From time to time the distinguished ministers and business leaders had to take time off to enjoy each other's pastimes.

The combo expanded like chain reaction. First, with one integrator, there was only a single point of active growth, which wound back and forth across the world like some monstrous vine. But when it touched the top managers of the great electrical companies, other buds sprouted. Now, at last, mass manufacture of integrators began, and the first products were employed to finish the preliminary phase of the plan.

Within five days the whole of Congress, the President and his Cabinet, and every military man above the rank of Colonel or Navy Captain, were captive. To prevent annoyance, the headquarters of the FBI and the Army's Central Intelligence Agency were taken. As a result of this move, came an interesting amalgamation: Howard Sipple, Marilyn Mills, and a small combo of twenty were brought into the fold. The group had been under observation by the FBI as a subversive organization, and their arrest was imminent when Dunn's combo took control of the Bureau and its files. Sipple's organization, it seemed, consisted primarily of police officers and detectives, endeavoring to trace Dunn's abductors.

But now events raced toward a climax, while the world blundered along unaware of the impending change. The Security Council was deadlocked over the American delegate's request for permission to bring a tape recorder to the sessions. Dunn succeeded in realizing his original dream. The visitors' galleries were packed with combo members, ready to steer the Council into the proper track. Dunn would have liked to have seen the radiation interrupt one of Russia's diatribes, but instead, it started just as the chairman began to call the afternoon session to order.

The conversion of the Security Council marked the high point in the life of the combo. For the first time in history, a group of brilliant and able men representing the highest development of conflicting national viewpoints, suddenly achieved perfect understanding. The assimilation took minutes. Newsmen beyond the range of the integrator could not comprehend the quiet agreement. Delegates from East and West then embraced, wept with joy, and swore eternal friendship. The Soviet delegate proposed an immediate trip to Moscow, and telephoned Malenkov to prepare a welcome. This demand jolted the Russian Presidium so severely that orders were prepared for the arrest of the whole Soviet delegation upon arrival. Needless to say, these orders were not followed, for both Malenkov and Molotov came to the airport to observe this lunacy, and were converted on the spot. The rest of the tightly-knit Soviet bureaucracy was assimilated within twenty-four hours.

Meanwhile research rapidly blossomed into mass production. Integrators by the thousand were made and installed on ships and in aircraft. Newsmen wrote of developments, especially on diversion of materials, but after a visit from the combo descended to only conformative announcements. The days passed in feverish production and positioning of the transmitters by means of test signals on an innocuous frequency, until every inhabited bit of land, every ship, every airplane was in range. At 9 a.m., Greenwich time, August 27, Dr. Dunn gave the signal.

Six hours before, 7 p.m. Pacific time, I settled down in my shielded room for a long test. I was completely isolated from every electric effect in the world for a period of 36 hours.

I finished my test at 7 o'clock on the morning of August 28. The integrators had been operating for 24 hours, until 1 a.m., local time. I escaped the Change by six hours!

The world was very quiet. The rays of the morning sun slanted into the hall outside of my lab, illuminating bright specks of dust in the air. Yawning and blinking in the light, I made my way across the campus. Nobody else was abroad; there was no life to be seen, save a flock of pigeons. I glanced at them casually, and then looked again. Something was wrong—very wrong. The birds clustered around another animal—a large grey tomcat! I changed course and approached the animals in amazement. Neither the pigeons nor the cat were frightened by my presence,

but they all turned toward me. The cat rose deliberately upon his hind legs and gravely saluted me with a front paw. At this the birds broke into excited cooing and chirping, almost like laughter.

For an instant I was horrified; then I remembered Bozo, and the answer poured over me like a wave. They've broadcast it! I stared at the cat and birds for a moment, and then returned the salute and groaned, "Good morning."

My wife met me at the door of the house, her face radiant. "Isn't it wonderful," she said. "And to think that you knew about it from the very start!"

"Anna!" I cried, "you too?"

She nodded happily.

"You should have told me—no, of course not. I wouldn't have understood, before. But now everything's all right. You know what I've been doing this morning? Calling up people. Old Mrs. Blakeman at the Bridge Club, who was so nasty last fall about the musical . . . why, she's a fine woman, she apologized to me! Imagine! The way we fought over who was to be chairman of the membership committee . . . Why, it was so much work and all I ever got out of the job was the satisfaction of keeping her from having it. I told her she could have it, but now she doesn't want it either. I guess nobody will be chairman any more!

"Mr. Petrillo, the roofer, who never fixed that leak, called me—wanted to come over right away and tend to it. We had quite a talk, all in Italian!"

"Italian? But, where did you learn Italian?"

"Why, of course. Italian, Russian, Chinese. Naturally we know best the languages that many people speak, But . . . but why do you ask?"

Anna looked doubtful, then gradually realization and pity spread over her face. It was an expression with which I was to become very familiar in the days ahead.

"Anna, I was in the shielded room last night. I'm . . . I'm no part of it."

In the next few days I learned something about the Change. What happened to humanity in a few charmed hours, I had to figure out by old-fashioned methods—observation, talking, reading. It was a slow and tedious process, which at first filled me with frustration and bitterness. Everyone was kind and sympathetic, yet I felt like an outsider and a freak. Everyone answered my questions, showed me the new co-operative nurseries and recreation centers that were springing up everywhere. Everyone tried valiantly to give me some idea of the change that had taken place in the minds and hearts of men. I could grasp the immense dissemination of factual knowledge and technical skills, but the heart of the matter somehow always eluded me. As I figured it, all of mankind was included in the magic circle of a single integrated human personality. When the integrators were operating, each mind was in actual telepathic contact with every other mind. Afterward, this close contact ceased, but immense and permanent changes had been wrought in every brain. The nature of these changes could not be put into words, but the consequences were obvious on every hand.

Thus Utopia came to Earth. Mankind's ancient disputes—strikes, crimes, vicious competition, religious bigotry, inter-racial persecution, and wars—all were gone! Gossip, backbiting, and the other petty ways in which people torment one another, vanished from civilization. It was truly a world of the Golden Rule. Telepathic communication ceased, but within each human dwelt an all-pervading sense of unity with all life on the planet, animal as well as human.

". . . he became literate."

Dumb beasts were changed in varying degrees. Dogs and chimpanzees became literate. Simpler creatures merely greeted every human they saw. Overnight men and animals became vegetarians, absolutely refusing to eat meat.

For a time I wandered alone across the country. Everywhere I was treated with courtesy and friendship, but as the days passed, I became increasingly lonely. People were always good and kind—far better than they had ever been before—*but they were all alike!* I felt most strongly the uniformity of my former close friends and associates, and most of all of my wife. Anna treated me with the same impersonal pity that nauseated me. Universal brotherhood indeed existed, but the old, intense, personalized affections were gone. I could dimly understand why this generalization must follow the erasure of sharp personal differences, but I still felt lost.

At first my mood did not encourage me to examine critically the new world, but even in my unhappiness, the less pleasant aspects of the Change gradually became obvious. The world was one of happy confusion. Only essential services were manned. Trains and public utilities operated in a haphazard way, according to the pleasure of the technicians. However, nobody minded the inconvenience. When the electricity went out, there were candlelight parties. When the streetcars failed, a great share-the-ride program went into effect. Police were unnecessary. The frequent fires were fought with gusto by whomever happened to be nearby.

The business and industrial districts of the cities were almost deserted. A few people went to work from

habit, but they spent their time playing games and carousing. As the days passed, I looked for sober heads to straighten things out; gradually I realized there were no "sober heads"—everybody was the same. When I met one human being, I had met the entire human race. Friendly, affectionate, utterly carefree, with no responsibility, no morality. People lived only for the moment. In vain I searched for the wisdom of the leaders, of the solid citizens who had kept the wheels turning. But wisdom was lost, averaged out by the overwhelming majority of lazy, fun-loving mankind. Individuals such as Dr. Dunn kept a degree of personal identity and at times were capable of rational thought, but, like men possessed by the fairies, they were apt at any moment to dissolve into complete hilarity.

And so, at last I realized what the combo had missed during the last days before the Change: they missed the exceptional men, the few who had climbed to the surface of the human stream, who gave stability and direction to the world. The idea existed before only as a statistical concept: the average man—the true democratic numerical average—had engulfed, by sheer weight of numbers, the wisdom and leadership which had sustained and protected him. Just before the Change the combo had indeed achieved great knowledge, because it had selected its members. And then, in one act, it undid all of the good, all of the millennia of slow, human struggle toward civilization, by capturing poor, happy, stupid, lovable, amoral mankind!

During the first weeks of Utopia I wanted desperately to be integrated into the world combo, and I asked Dunn to set up an integrator and bring me in. But he regretfully turned me down, because, he explained, it required world-wide coverage to tie me in completely. A partial integration could not do it, and besides, it would upset whoever was involved to absorb part of my frustration and inadequacy. He added, however, that in six months or a year when the Survivors had all been discovered, another world integration would be held.

There were others beside myself! I had never heard the name, Survivor. The news that there were yet human beings formerly considered as normal, filled me with excitement, and I at once tried to seek them out. This was not easy—not because integrated humanity objected, but because integrated humanity simply didn't care. People were too busy with their own new happiness to bother about poor Survivors.

It was more than a month before I came face to face with a man like myself. He was a very unhappy gunner's mate, second class, from a submarine. He had jumped ship and "gone native" when his craft made port, three days after the change. The sub had been on a long practice dive during August 27, and its crew had been shielded by the steel hull and a hundred feet of salt water. Where it was now, the sailor did not know, although he guessed it was in port, because it was impossible to get stores, fuel, or even orders at the Brooklyn Navy Yard. We hurried to New York. Six harried officers lived aboard the undersea craft, while the crew made merry with the integrated citizens of Brooklyn.

It required many months of mutual searching for all of the Survivors finally to find one another. Besides sixty-seven men from the submarine, there were forty-one members of a scientific expedition to the Antarctic who returned four months after the Change. There were hundreds of slaves freed from subjugation in a Russian mine, who first discovered the new order when a committee, headed by Stalin himself, came to welcome them back to freedom. There were other groups of people who were shielded by magnetic effects or tricks of radio transmission. The total was almost four thousand. The wonder of it is, not that there were survivors, but that their number was so small. The combo had been most thorough in its coverage.

The Survivors met in small groups at first. Later, through the organizing ability of Sir Albert Gale, the head of the polar expedition, we all gathered for a convention in Arizona. We halfway feared that integrated humanity might object, might in some way see a threat in the organization of Survivors, especially since industry and communication were crumbling into chaos, and there was a growing food shortage. But our worries were groundless. Ragged and hungry, but still happy, they waved to us from every roadside as our cars converged upon the meeting place. When Dunn heard about us, he offered to advance the date for our Integration, although by this time disorganization had progressed to the point where such a project was a technical impossibility.

At last we all sat together in an open stadium near Phoenix. I found that my own observations and views were generally shared by the others. Some were still in doubt, others still tried to hold to the tinsel and glamor of the first days, but all listened eagerly when Sir Albert Gale arose to summarize the situation.

"I believe," said Sir Albert, "that we have a valuable advantage in observing the Change, for we must be objective to gain understanding. Most of what we saw at first was truly utopian. We saw the realization of the dreams of every philosopher since the world began. It began in a flash of joy so bright that we Survivors sickened with envy and despair. Even the physical decline could not convince us that it was all wrong. The people were still happy after all, and is not happiness the goal of life? It is our duty to analyze, for we alone are capable of analysis; we alone have independent minds to make discussion possible. Let us consider for a moment the brotherhood of perfect mutual love and appreciation. It destroyed much evil indeed, but there is another side to the ledger. There is motivation, the inner drive, which makes us work and struggle, and creates the sum of human progress. Part of this motivation derives from the physical hungers, for food and a mate. The drive keeps civilization going is spiritual—the desire to grow, work, and gain the respect of our fellows. Such desires often lead to much unhappiness. But they provide the incentive for achievement beyond immediate need. Civilization is not built upon carefree play; it rests upon the labors of men, many of whom did not know how to play. But now motivation is gone. We see so-called perfection. What will happen now? Civilization cannot be static, it must advance or fall. Perfection, as with ripe fruit, is followed by decay.

"We witness the start of the degeneration. We watch endless playing and wandering about, and the breakdown of orderly work. Some things we applaud: generosity of the rich, sharing of homes, cars, clothing. But we also see the death of ambition. Every activity that does not create pleasure at the moment, is abandoned. It is tragic to realize that our *dreams must forever remain dreams!*

"We Survivors face a dreadful responsibility. Let me give you the facts of the situation and my thoughts

as to what we might do to bring order out of chaos.

"Since the Change, the best of our remaining unaffected scientists have determined conclusively, that certain brain cells were injured by the integration. Therefore, even if it were possible to reverse the effects of the Change, it is doubtful if the peoples of the world could be restored to mental normalcy.

"Fortunately, there is no evidence that the high-frequency currents which damaged the brain and caused the Change, have had any effect whatsoever upon the genes of the body. Therefore, any children born of such parents should be unharmed.

"We must resist, then, the easy way—the way of integration. We must await the end of this generation, and perhaps the end of the next, for our children, while normal at birth, shall have been corrupted by the *example* of their parents. It may be many years before the last trace of this—*this upside-down Utopia*—is gone.

"In the long course of history, this may prove to be a milestone in man's social progress, for the newer generations will follow our principles of brotherhood. They will learn true values of life as well as the correct scientific method for progress. We may yet make a world in which the concepts of brotherhood and tolerance are *consciously* practiced, yet with man's ambition and driving energy must still be strong and channeled in the proper directions.

"Our responsibility is surely plain to us all. We must keep records for the day when bewildered man will ask, 'What has happened?' We must guard against a reversion to a new stage of savagery . . ."

As I was copying these words from my notes, these words of Sir Albert Gale, a shadow fell across the room. I looked up guiltily as a Utopian visitor noticed my manuscript. For an instant fear gripped me, but I relaxed and we laughed together. Some of his friends joined us.

"You know," I said to the group of happy people who stood beside me, "I feel just like a conspirator plotting treason against mankind."

One chuckled gaily. "We don't care," he said. "You poor Survivors, always reasoning things out! And your reasoning always makes you so unhappy! But now, forget all this dreary, sad stuff, and come to the beach—they've just invented the craziest new game you ever saw!"

"We witness the start of degeneration."

". . . the next second, we're . . . on Callisto or Ceres."

THE BIOLOGICAL REVOLT

by PHILIP JOSÉ FARMER

(Illustrations by Frank R. Paul)

Philip José Farmer

Mr. Farmer has been hailed as the greatest new science-fiction discovery since Stanley G. Weinbaum. He is at present working on a Master's degree in Philosophy, with strong side-interests in semantics, biology and chemistry.

The world now enters a new cycle, that of the antibiotics and wonder medicines. Good as these scientific remedies are, scientists already warn us that the human body is beginning to manufacture new bacteria, new microbes, which, in turn, create unknown virulent diseases. Man now eats more chemicals than ever before. ***Our daily bread is loaded with chemicals; the fowl, beef, and particularly pork we eat are all loaded with antibiotics. In his eagerness to make money, man stops at nothing. When will the human body revolt and break out in new, loathesome diseases? This is a serious problem for today's health scientists. The problem is world wide.***

1

The dark lines of a man's head and shoulders cut across the brightness. The silhouette hung in the frame and then bent forward to look into the room.

The figure turned so he would not block the shine. He looked upon that part of the bed lit by the moon and upon a woman who slept.

"Barbara," he whispered.

"Barbara!" His voice trembled with loneliness.

The woman jumped from bed, scooped up a gown and slid it on. As she tied the strings across her bosom, she wheeled upon the man outside. Her voice was shrill. "Go away, Bill! Go away!"

The recent presence of another man was obvious—a shirt and a necktie hung on the door knob. The piney odor of pipe tobacco remained in the air.

"Barbara, I'm sick. Very sick. I need you."

She stepped backwards from him, slowly. "There's nothing I can do for you. If you were dying, I couldn't even hold your hand."

"It's not true, Barbara." His voice was lower and more controlled, and his eyes were red and hot. "You could at least take *one* shot of anti-asp. You could talk with me without being affected."

"No, the anti-asp shot is just a trick of yours. If you loved me, husband dear, you'd not ask me to take one shot for you. You know how terrible the asp is! Do you want me to suffer, too?"

"Barbara! If you knew how lonely I am."

Trembling, she said, "Besides, how could you want me now?" She glanced at the door where the man, Travers, had left.

He gripped the sill tighter, as if the house were whirling and he didn't want to fall off.

For the first time, she stepped toward him. She yelled, "Do you think you are the only one who's lonely?"

"No, no—I understand. But remember, Barbara, we said, 'for better or worse, till death do us part.'"

She screamed, "Get out, Bill. I wish you *were* dead! You *are* dead, to me! Get out before I kill you . . . Or myself!" She turned and ran through the door.

2

The man walked alone.

His passage from the house through narrow woods was marked by solitude and terror. Mosquitoes, thirsty, swooped toward him. Closer, they suddenly angled off and flew away. They wanted none of *his* stench. A frog, sitting apart from the path flopped away panicked through the weeds. A coon, clinging to a branch and complacently watching the man, suddenly sniffed. It scuttled up the tree and clung to the bending tip. This man, Bill Ogtate, was the Asp.

The terror he breathed and sweated with every second was his curse. Victim of man's revenge and ingenuity, he was doomed for eight years to imbue with the asp all who came close. His free will had been violated, but the horrified world could not help him. Their sympathy and aid came from a distance; nobody could hold his hand or call him brother.

The Asp was impregnated with that giant protein molecule called—the asp. It was forcibly injected into his bloodstream where it spread to every part of his body. Utilizing the electromagnetic field of the body cells, the asp attached itself to each cell so that the host must "share" its field with the uninvited guest. Many of Ogtate's cells inhospitably refused, and the commensals secured a foothold only on about an eighth of the total.

Bill Ogtate's weight increased with the swarm of semivirus. The demand for more energy aroused his appetite. His metabolism accelerated, and his body, to control the increased energy-output, released it in heat and sweat as in exercise. The internal body temperature thus remained normal and constant.

Ogtate's skin was the primary transmitter of the "bite," as this emanation came to be called. Asps radiated continuously from him, although the rate varied according to reproduction. When asps attached to a certain organ built up to a certain bulk, the host was unable to endure any more accretion. They threw the switch, so to say, cut off some power, and weakened the link between the negative and positive poles of host and guest. Though some asps always clung, others were kicked off and thus emitted from the Asp. They left his body via breath, skin, and other means of voiding. They floated through the air to be breathed or otherwise absorbed by whatever living thing happened to be near.

Ogtate himself was immune to the reaction his presence induced in others. Though burdened by the giant molecules, his sympathetic nervous system and adrenal glands, which were particularly affected in

others, were quite indifferent to the asps. They were injected into his blood along with an antibody. The antibody depended upon the closed field of the adrenals for reactivation. Although it could not, unfortunately, kill the asps, it kept them from stimulating the adrenals. It did not, however, deaden these organs to other vital stimuli.

Ogtate breathed and sweated as a man must. The invisible miasma put out long fingers through the air and plunged them into the lungs and skin of any living creature that came near. In a short time the fingers felt the blood. They wrapped themselves around the medulla, the inner portion of the adrenals, and they squeezed.

The effects were immediate. Adrenalin poured out, activating the sympathetic nervous system, attached closely to the glands. The person thus "bitten" felt at once the hardbeating heart, the shallow and jerky breaths, cold sweat and rising body temperature, shaking of body and paling of skin, standing-up of hair, halting of digestion, loosening of muscles, dilation of pupils.

Above all he felt suspension of reason.

Added together, the symptoms characterized one dominant emotion.

Fear.

There was but one thought body and mind had: Get away—fast.

Actually, there was no chance for permanent damage to those who were affected, as long as they went away before their systems were overstimulated. The asps attacked only briefly before being excreted. To get a hard grip upon the cells, they had to be suspended in a nourishing fluid and injected into the blood. The nutrient gave them strength to hook into the host's electromagnetic field.

Although the Asp's bite was at times strong, at others weak, according to the rhythm of their reproduction, he always radiated enough that he could never be approached by unvaccinated people.

If he were a rabbit, he could safely have hopped through a den of hungry lions.

But he was a man who would have welcomed even the company of a lion.

3

The visor in the front room of the Ogtate house bonged. Barbara walked into the front room and pressed a button. The screen sprang from blankness into full life color. Seemingly, a man stood before her.

"Mrs. Ogtate, I am General Yewliss of the Terran Psychological Corps." The tones, like the man, were sturdy and dark. Once you heard them, you didn't forget.

She nodded and said, "I've seen you on the news, General."

He wasted no time, but like the big red-black bull he so much resembled, charged at the point. "Mrs. Ogtate, I'm going to ask you if you will forgive me for interfering with your free will. Believe me, it was absolutely necessary for the good of Earth."

"What did you do?"

"Mrs. Ogtate, for some time we've had a detector alarm buried near your house. We call it a 'rattlesnake.' When the person whose presence it is set to detect comes near, it sends out a signal. Its receiver is this." He tapped a little box on his wrist. "I've been wearing this day and night. Ten minutes ago I was awakened by its alarm. *That meant much to me.* It meant that your husband, undoubtedly the most important man on Earth, was at your house."

He paused, then added, "And it implied much more."

"What do you mean?"

"Just this. Bill Ogtate finally broke under the pressure of loneliness and ostracism. He knows that you, the person he loves more than any other, will not share his exile, yet he's desperate enough to make a hopeless plea."

Paling, she said, "Have you been spying?"

His broad swarthy face split showing white teeth, and his large hand passed over his closely-cropped black poll with underlying red glints. "Hardly. Even the military don't do that nowadays, Madame. But the Psych Corps has many resources. One is the *Computer of Probabilities,* the so-called 'giant brain' at New Delphi. Given all available data, it estimated he should break down about this time. Especially if he were sick. And that he should come to you."

Scornfully, she said, "Do you need a machine to tell you that?"

The General smiled slightly and said, "Your rebuke is accepted. To tell the truth, I figured it out independently, too, but one must have the backing of authority, you know."

He became brisk. "Would you mind telling me, Madame, if our surmises were correct? He did make an appeal, didn't he?"

The General's eyes went over her shoulder. She didn't turn around, for she knew by the oriental aroma of cigarette smoke that Tom Travers had come into the room.

"Yes, you were right," she said. Her eyes looked straight into his; her back straightened and her shoulders squared.

He said, "Please don't get angry, Mrs. Ogtate. I make no moral judgments. One lives as one must."

"I'm not interested in what you think. What else do you want?"

He glanced at her trembling lower lip and said, "Would you care to sign a waiver over our violation of your free will? Remember, we are trying to influence your husband to give Earth the Belos."

"I know that. Don't you think the Government has approached me enough on that subject. And," she suddenly shouted, "my answer to them is still 'no'!"

"I'm well aware of that," Yewliss replied, "That's why I didn't renew the plea. If you'd answer my question, Mrs. Ogtate, we could end this. The hour is late. I'm sure you're anxious to get back to . . . bed." He

"They wanted none of his *stench."*

paused, and she wondered if he shot an amused glance at Travers from under his lowered lids. Then he continued, "And I have to work fast. Earth's existence is in the balance."

His words did not affect her, for he said them so prosaically. However, she was tired of the subject. "Send the papers. I'll sign them, provided I have your promise you won't bother me again."

He spoke quickly. "You have it. Papers won't be needed. The recording of our conversation is sufficient. Thank you, and goodnight, Mrs. Ogtate."

Travers came from behind and put his arms around her waist. Smoke blew around her face. "You need sleep. I think I'll make coffee for myself."

She turned in his arms and put her head on his chest. "He saw you."

"So what? Do people pay much attention to such things any more?"

"You don't understand. If I would go to Bill and say I'd live with him, I'm sure he would turn the Belos over to Earth. The war would be over. But I can't. They can't make me do it. I am so lonely. If it weren't for you, I don't know what I'd do."

"Move away with me. Get a divorce."

She raised her head. Tears sparkled. "I will, Tom. Tomorrow."

4

Gathering his thoughts on this strangest of all stories, Yewliss went to his desk. He pressed a button; his orderly came in.

"Everything's ready?"

"Yes, sir."

"What about the woman who's going with me?"

"The Comprob took a long time selecting her, sir. Seems it had a lengthy priority request to fulfill first. And your specifications were extraordinary, sir."

"I didn't say they had to be met to the iota. I just wanted the nearest thing. This is too big for picayunish perfection."

"We've met them anyway, sir. The woman was doing medical research on Eros. We finally located her. She should be here any moment. Eros is at its closest to Earth now."

The General unwrapped a cigar. Suddenly, he stopped, rigid. "Wait a minute!" he roared. "You said Eros? Doing medical research for the Army?"

"Yes, sir."

Yewliss breathed deeply and said, "You know her name?"

"Yes, sir. Here's the information. Major Killison. She's even got the same first name as his wife, Barbara. She fits your requirements to a T."

Yewliss looked as if might throw the cigar in the orderly's face. He scowled and said. "That's all for the time being, Brown. Notify me when she gets in. Have her report at once."

The noncom was puzzled, but glad to escape from the office. The Old Fox wasn't living up to his name. He was more like a big black bull seeing red.

When the door closed, Yewliss stuck the cigar between his thick lips, lit up and drew in and puffed out smoke through his nostrils like a virgin-eating dragon. "Barbara Killison, by the gods! Won't that make them hold their sides and laugh!"

When the cigar had become a stub of ashes, the orderly knocked on the door and announced Major Killison. Yewliss, trying to control the rage in his voice said, "Come in!" He rose and faced the door.

The woman was longlegged and narrowwaisted and deepbreasted. She had thick wavy red hair. She bore a more than superficial resemblance to Mrs. Ogtate. She saluted.

Yewliss returned it and then said, "Drop the formality, Barbara." He went up to her and took her shoulders, broad for a woman's, in his big, dark hands and looked her in the eyes, level with his. "Barbara, I'm sorry you had to come all this way for nothing. Yet, I'm glad for myself. I haven't seen you in three months." He tried to kiss her, but she turned her head.

"What's the matter?" He squeezed his eyes. "You've met somebody else? Who? Colonel Singh?"

"Don't be so damned silly-jealous," she said in a slow fluid voice. "Do you expect me to kiss you and then get your blessing to go away and throw myself at Ogtate?"

He laughed. "So that's it? Barbara, if I weren't in such a hurry, I'd take you out for a drink. We could have a good laugh over this. No, Barbara, I didn't know you were the one chosen. I sent the specifications to the Comprob two days ago. Some civilian had priority over me. When it finally started on my problem, it took all day to find what I wanted. Then the military attachés sent a message to you. I didn't have time to find whom it'd found, because I've been working on *Project Asp* night and day. See? Still mad?"

"May I smoke? Yes. Well, dear, there's something you forgot." She relished the smoke a second and then let it float, genie-like, from her lovely mouth. "You forget, I was told *what* I am volunteering for. I came into this of my own free will."

"Were you informed you might have to marry Ogtate?"

"I was."

The temptation struggled on his tongue to say some stupid cliché like "But how could you?" Fighting it, he walked around his desk and sat down and put tight fists on the plastic top. "Let me get this straight. You no longer love me?"

"I never did, remember? I did say I'd marry you. I admired you more than any man in the world. I think I could respond to you with every response that marriage demands. Perhaps we could become the much-talked-about ideal of psychologists and priests: one flesh. But I never loved you."

He murmured, "That's right. I forgot. I equated your promise to marry me with a confession of love."

"That's not like you," she said. "The Old Fox never forgets, they say."

"The Old Fox has been outfoxed by the one who can do it best." Yewliss replied. "Himself." He unclenched his hands, spread them out on the desk and looked down at them. "So I've brought you here only to turn you over to the Asp? And I must do my best to see he takes you?" He struck the desk top. "I don't have to do it! Barbara, I reject you for this mission!"

She walked across the room and sat down in a chair, which molded itself about her long curves. Many a man would obviously have liked to trade places with it. "Yew, I know you can't reject me. I sent a message to New Delphi. The Comproberators told me the girl next in line was more than fifteen points off classification. I'm the only one who has a chance for success with Ogtate. And that chance is only 60-40. Moreover," and she leaned forward so suddenly that the reluctant chair made a popping sound, "you can't order me not to. The mission interferes with my personal rights. I'll ask the Comprob for a review of your order, and it'll verify my stand."

He groaned, "Oh, for the good old days, when a general's word couldn't be countermanded by an unconscious electronic gadget! Very well, Barbara. I wouldn't try to force you. You're an adult, and you've free will, modified, of course, by circumstances." He rose and reached for his cap. "I still can't understand why you volunteered. I hoped I meant more to you."

She rose, too, and smoothed the top of her cap, which had been folded in her belt. "What's the most important problem of Earth today?"

"You know it's Ogtate. He must be wheedled into giving us the Belos. Otherwise, we lose the war and, quite possibly, become exterminated. The Belos is so important that the Government may pass a special case law to force Ogtate to tell. But he can't be forced. Drugs or even torture—though that, of course, is out of the question—would only scramble the equations in his mind. There's no way of breaking *that* post-hypnotic block."

"Then why are you so surprised that I volunteered?"

"I'm not, Barbara. It's just that one part of me, the man that loves you, can't accept it. The soldier understands."

She put her hand on his arm. "I'm really sorry," she said in her deep and soft voice. "But I'm just idealistic enough to hold Earth's welfare above mine."

He withdrew a little. "Don't feel sorry for me. This affair isn't over. You're not Ogtate's yet. Tell me, if you don't have to become *aspate* yourself, will you still marry me?"

"Dear Yew! I thought your pride would be so hurt that you would have no more to do with me."

"It is hurt. But I love you. And you didn't answer my question."

"If I don't have to be aspated, I'll marry you."

He clapped his hat on and said, "Good! Major Killison, will you come outside with me? The copter's ready."

"Yes, sir." She smiled a little.

5

Outside, they walked upon the broad field, two forms threading between shiny pools of glass blasts made by rockets. They wandered beneath an enormous Mississippi moon, Killison gazed at the many buildings and towering silver needles and said, "All this was built because of one man?"

He nodded and said, "That's how important he is. The military know it, but we can't beat it into the heads of our citizens. Most think the war is ninety million miles off. It is, *now*, but any day the noses of Priami ships may materialize out of the air."

They stepped into the copter and strapped themselves in. Yewliss checked the instruments, and then lifted up the ship.

"According to my men, Ogtate flew back to his island where he'll be licking his wounds, and there we'll help him. Or, rather you will."

She placed her hand upon her doctor's kit as if to make sure it hadn't dissolved. "How do you know he's sick?"

"His wife told me. Besides, the Comproh submitted he'd be most likely to break when he was sick."

"I don't think it's malaria," she said. "I understand there is still some along the Amazon and the Congo. But there hasn't been a case on this continent for forty years. His fever may be psychosomatic."

"Possibly from an allergy," he said.

She glanced at him, wondering why he'd said that. "One of the reasons I volunteered, although by no means the strongest, was to study the asps. I don't agree with my colleagues who maintain that the effect can't be wiped out."

"You'll get nowhere. We offered to place him in a lab where Earth's best brains would study him. He refused. He said they might work twenty years before they found anything. By then, the asps would have worn themselves out. Besides, they can discover as much using test animals as they could with him. He doesn't want to spend all that time behind glass windows, like an ape in a zoo."

"Or a snake in a pit," she added.

"In one way, I don't blame him. But he hasn't been at all co-operative. The main reason he wouldn't allow himself to be placed under observation is that he's afraid we'll pry the Belos out of him."

She leaned back and gazed from the window. "The night is beautiful," she said. "The moon is giving herself to every lover in sight. I've never seen a nightscape like this."

Then, as if her senses had been talking for her while she was thinking about something else, she said, "The major who met me at the transmitter briefed me. Perhaps you know more than he, a weakness of Ogtate's that you, as a psych, might have noticed."

"Tell me what you know. I'll fill in anything you've missed." As he looked at her, he fought against his consuming desire to place his arm around her shoulders. She was Diana, bright and full at times, shadowed and crescented at others, far off yet just beyond tiptoe reach, a blend of majesty and of passion. If she were to become Ogtate's, could Yewliss find her equal? Realist that he was, he knew there were women just as beautiful and intelligent and strong-spirited. Many would gladly be his mate; many could satisfy him in every way and would make him love them. But they were not Barbara, the only one he wanted.

Closing her eyes, she talked. "The story as I know it began about three years ago. The Priami warned us to stay off Mars. Dr. Erkells, a physicist, and his assistant, Ogtate, were working on a device they thought would make interplanetary war impossible, or at least, extremely difficult."

She opened her eyes and said, "Yew, am I boring you? You know all this, of course. It is so fantastic, so fairy-like. We step into booths, sit down, and, in what seems to us the next second, we're halfway around the Earth, or on Callisto or Ceres. And Erkells was going to wave his black sorcerer's wand and put an end to that. Of course, it was for a good cause, but how many bad deeds are done for good reasons? He even would have stopped EPB-travel between Earth cities, for the Belos would have distorted the waves so much that we'd be quite scrambled by the time we arrived at our destination.

"Nobody thinks about that. If Ogtate tells us the secret, we defeat the Martians. But we also go back, for a while at least, to flight on the wings of matter. Our magical energy-chariots are grounded. Yet few realize this: they're all so blasé and talk about weekends in Paris or Luna Port as if they were hot-dog stands down the street. So do I, but now and then I wake up and catch my breath and say, 'Babs, *can* this be? Is this *you*, in *this* age? Why, Babs, Louis XIV or Pharaoh Cheops would give all they had to be the commonest citizen of Earth. And wouldn't Shelley or Poe or Dunsany or Li Po have signed in blood to step

through the magical gate of Space and Time annihilated? *How* can we look around and not run screaming down the street with joy? *Babs,* this is *you, now!*"

He patted her hand. "I like you, Barbara. You're one of the few people I know who aren't walking corpses. You're alive. Your eyes aren't world-shot. Others live horizontally; you, if you can see what I mean, live perpendicularly."

She closed her eyes and put her head back. "So," she resumed, indifferently, "when the war began, Erkells and Ogtate were working hard on the theory of their weapon. They succeeded in thinking out the equations. It was a marvelous invention, and, if given to both sides, would make interplanetary war impossible. Before Erkells could begin work on the practical part, however, the human element entered—though, perhaps, it had never been absent.

"Erkells fell out of love with his wife. She knew it. She knew the young woman he intended to marry after the divorce. So, because she didn't want to lose him, she looked for something to prevent his going to the other woman. She found help in an assistant of her husband's, a man who was on the point of losing his job because his love-life interfered with his work. In this case, although Erkells didn't know it, the assistant's trouble sprang from Erkells' wife. She, thinking she could trust him because he was fond of her, asked him to help her. He gave her an *illegal* drug. It was a post-hypnotic affecting thalamocortical integration. Once it was fed to the scientist, he'd not be able to resist his wife's suggestion that he abandon his bride-to-be and continue happily married to her.

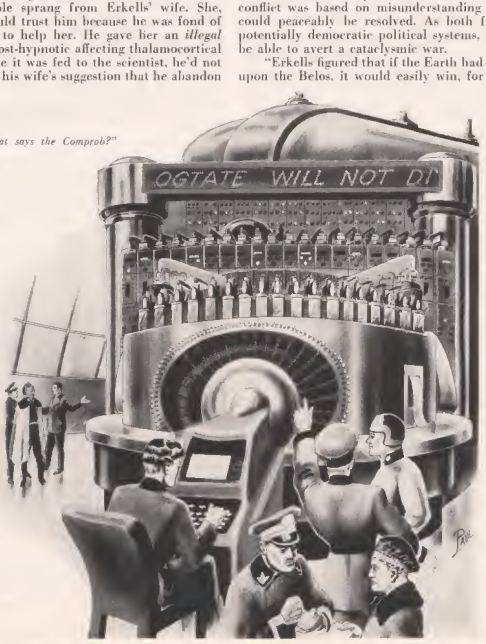
"Sounds Dark-Age-ish, doesn't it? So it is. Technologically, we're in the Golden Age, but people change slowly. They take a long time to come out of the Brass.

"Unfortunately, the assistant, by means of the drug, implanted the suggestion that the physicist destroy himself by fire! Suggestion is not easily effected, and it has little chance of success unless there is a similar, strong neurosis or psychosis already buried in the subject. This was Erkells' case, as the assistant knew. His victim, however, fought his growing insanity. He went to a therapist, and in time the doctor would have discovered the cause of his aberration. Not long afterwards, though, Erkells' copter crashed while he was flying to the therapist's office. He died of radiation-sickness from the broken fuel-tank.

"Before he died, he did something he had sworn he would never do. He gave the secret of the Belos to his scientific colleague, Ogtate. The master himself had done all of the concluding work on the equations. When he surrendered his knowledge, however, he made the young man swear he wouldn't give the weapon to Earth, unless she was in danger of annihilation. Erkells was a pacifist. He believed the whole conflict was based on misunderstanding and that it could peaceably be resolved. As both factions had potentially democratic political systems, they should be able to avert a cataclysmic war.

"Erkells figured that if the Earth had a monopoly upon the Belos, it would easily win, for the Priami

"What says the Comprob?"



would not be able to penetrate our power fields. Conquest would therefore be so easy for us that we might become an arrogant, empire-building race. We would lose all the ideals and freedom we have gained in the last two hundred years. Moreover, he thought the Priami were no different from Terrans."

"He had never seen one of those monsters!" interrupted the General. "Nor one of our Callistan stations they've bombed."

"No, that's certain. Anyway, the assistant and Mrs. Erkells were sent to a therapeutic institution. Ogtate was left with the burden of decision. If he didn't divulge the Belos until Earth was in danger, he might be too late, for it took time and organization to set up the equipment for the field. But if he told scientists the secret, he might launch the moral downfall of his people."

"Idiot!" said Yewliss. "How can he linger in mist and moonshine with the threat of bombs?"

"I intend to find out," she said, and squirmed to find a more comfortable position. He watched the shifting of curves, the upthrust of breasts, the rotation of hips below the slim waist, as she settled back with a sigh. He closed his eyes and gripped the wheel.

6

"About this time," she continued, "Ogtate joined the Militant Pacifists Party. Inasmuch as everyone knew he alone kept the Belos' secret, he rose quickly to a high position in the MP's. He led them in their demand to sue for peace at once—even if we had to forswear all claims to any part of our system. He thought the Priami—a reasonable race, according to him—would be so impressed with our generosity they would come to terms. But his opponents insisted our contacts with the Priami were enough to prove that we were dealing with devils.

"Despite this, Ogtate presented to the Council a law that would halt the war. His opponents claimed that, if the law were passed, we would be slaughtered, unless he would hand over the Belos.

"The night before the law was to be considered, Ogtate was seized by a band of masked men. They *aspated* him! People were horrified. They decided to vote the Council out of office at once, for they suspected that the men who'd done the outrageous deed were of the same party. That very night, however, the Priami helium-bombed Callisto. So the government stayed in power, and the MP's dissolved from lack of adequate membership. The government did everything they could to make up to Ogtate. Too late. He lost his wife and children; his friends deserted him; he was forced to live alone."

"Here we are," said Yewliss.

The copter crossed the moonspotted Mississippi and settled down upon a heart-shaped bit of earth: Lemons' Island. Artificially built, it had once been a pleasure resort. Ogtate had requested it and got it. The craft landed in a clearing before a large, white house built in pseudo-prehellum style. Although there were lights inside, no one appeared at the doors or windows.

When the wheels touched, Yewliss took a hypo from a kit and injected the contents into Killison's left arm. "It's 0100," he said. "You have ten hours before the effect wears off. After that, take no more, *or you'll be sensitized.* Second shots have been tried on lab animals; *they always die.*"

"You forget I'm an M.D.," she said, sharply. She took her kit and began to climb out.

He pulled her back. "No kiss?"

"If I fail in this mission, we'll have enough time for that then. Meanwhile, silly as this may sound, I'd feel unfaithful to Ogtate if I kissed you."

"Just a meeting of the lips?" He wasn't sure whether she was kidding him.

"I put all of myself into a kiss. Nothing's held back."

"The asp has affected you already," he said trying to carry it off with a laugh. Even to himself, he sounded dismal. "Remember," he called after her, "to contact me at once if anything comes up."

She waved goodnight and walked off. A moment later, his copter whirred away.

General Yewliss set the automatic controls after leveling out his copter and turned to the visor. Idly, he twisted the dial until a New York program jumped upon the screen. It was one of the many discussion panels filling the air, and this, like most of its competitors, was discussing the Asp and the Belos. Although the panelers were scientists and intellectuals, they had nothing new to offer. Yewliss listened with half an ear and then cut them off.

Everybody knew that when Terrans went to Mars, they found underground colonies of the so-called Priami. This race had come to the solar system from a star's planet system that long ago flared into a nova. Knowing their fate, the Priami had escaped by means of a unique form of interstellar travel. Years before they themselves emigrated, they launched a ship driven by ion beams and containing automatic energy-matter wave receivers and converters. Then the beings were passed from matter into alpha energy-waves and were beamed to the solar system, which they knew had planets.

After fifty years of near-lightspeed travel, the ship entered the sun's gravitomagnetic field, which electron-triggered the machinery. The wave-charts, not as yet deteriorated by the rather short trip, fed into the converter. The coded pulses were then metamorphosed again into matter: spaceships and crews.

It was during the mid-1940's, that Terrans themselves succeeded in their first experiments with energy-into-matter conversion. They didn't know, as they celebrated feeble success in creating several atoms from energy and adding them to some carbon molecules, that the Priami not only anticipated them by quite a few hundred years but used the classic development to survive as a race.

The newcomers, noting the large population, industries, and quarrelsomeness of the Terrans, ignored Earth and burrowed into arid Mars. They freed oxygen from the rusty rocks and contented themselves with sending occasional space ships to report on their neighbors' progress.

By the time man's rockets reached Mars, the Priami were beginning to build on the surface, whose sterile soil was being converted to fertility. In several more centuries they would make of the red globe a smaller, but green Earth.

Only one thing could destroy them—man.

Strangely, the Martians didn't fear man's bombs or diseases or rapacity. They dreaded a factor which man himself would never have considered a weapon.

Man was a liar!

The Priami could not lie, or rather, if they did, it was by a super-effort of will. But then they went into psychosomatic decline and death, often suicide. Prolonged and intimate contact with man would lead to race extinction.

Nonlying was a culturally-conditioned character-

istic. Many Priami, realizing they would inevitably have to face man in numbers, tried to change their culture. They were determined to teach themselves to lie and to listen to lies. However, the flexibles met opposition. The change was delayed so bitterly that it would be centuries before Mars as a whole would be a planet of prevaricators. Meanwhile, the Priami issued ultimatums to keep off Terrans. When man, unable to take their life-and-death problem seriously, persisted, the Priami attacked Earthmen in self-defense. The first interplanetary war had begun.

Independently, Terra evolved its energy-matter converters and transmitters. During the mid-twentieth century scientists photographed individual atoms with electron microscopes. Out of these were born electronic scanners that could "blueprint" the most complicated matter. Combining these with the converters, the scientists could disintegrate a rocketship, atom by atom, and beam them in pulses, to be reassembled at a distance.

By Yewliss' time, they proved that electrons consisted of points of convergence in lines of force or energy waves. They formed positive and negative convergence points from energy to build atoms, and so on up the scale of size to complete man.

Humankind was justly proud of this achievement, but soon found that the EPB-converters could only be set up on Earth, Luna, Mercury, Venus, Jupiter's moons and some of the asteroids. The Priami had stations and colonies on every other body worth occupying. They warned that if man transgressed, a converter ship would drop close to Earth and would materialize a whole fleet of war-vessels.

Earth could do the same to Mars, but retribution would follow.

There was a stalemate. Yet, a move could be made, and Terra could make it. She knew of a new weapon that could nullify enemy Energy-Pulse-Blueprint Realizers, while her own dropped unmarked upon Mars. It was called the Belos, the Greek word for weapon. The principle of the Belos was known quite well. The application was not.

According to theory, a series of tremendous generators from North Magnetic Pole to South Magnetic Pole, geared thus to the Earth's electro-magnetic field, would produce a shell of energy around the globe. This shell corresponds, for various scientific reasons, with the ionosphere, and would work on a principle first deduced in the 1940's by two British astronomers. This was the idea that the universe was expanding and being kept from entropy because hydrogen atoms were continuously forming in space. Later, scientists found that it was, instead, electrons that formed *de novo*. These, along with some short-lived subatomic particles, came into being when *gravito-magnetic* lines of force converged.

Founded on this discovery, the Belos shell consisted of shifting electro-magnetic stresses, statically bound to cross enough energy waves so particles would be "created". Thus, if a Priami materializer-rocket penetrated the Earth's atmosphere with the intention of converting a huge fleet in the air, before the Terrans could do anything about it, the attack would be thwarted. The Belos would generate "endo-static", mixing the matter with foreign particles, then adding or subtracting electrons from the new configurations, making accurate materialization impossible.

If the converter-ship stayed far out of the Belos, it might as well not leave its home port, for Earth radar would pick up the distant Martians, and send interceptors. To be effective, the invaders should come into being at close range, but as long as the third planet had the Belos, they could do it. Only one man knew *how* to put the Belos into operation. He would not tell. His name was Bill Ogtate.

7

Bill Ogtate was sitting at a little table, contemplating a queen, when he heard a copter cutting the air outside. "You'd better take off," he said to Smith, his opponent.

Smith withdrew a *three-fingered hand* from a king. "Take off? That means fly? Remove? Unveil? Imitate?"

"Fly. Flee. Run. Dismiss yourself."

"Dismiss Smith? Ah, go away! But who would visit *you*?"

"Well, you have," said Ogtate. He smacked his lips as if his mouth tasted bitter.

Smith stood up. There was a strong light behind him. The pulsing of his green-blue bloodstreams and the slow squeezing of his intestines showed dimly, as in a fog. You could never accuse Smith of being thick-skinned.

Smith talked from behind a two-foot-long, elephantine trunk and a fleshy, walrus mustache. From time to time little spearheaded teeth showed in his mouth. There were two rows that moved sidewise in opposite directions. Here was the original living meat-grinder. "Do you have any cigarettes on you?" he asked, his voice amplified by the large throat-sac hanging from his neck. "If your visitor is female, I may be in the ship for quite a while. I haven't any smokes down there."

"I'm sorry I taught you to enjoy tobacco," said Ogtate as he tossed a package.

The Martian caught it in his trunk and walked to the corner. There he lifted the rug, opened a trap-door, and climbed through it. Ogtate replaced the rug and walked to the front of the house.

When he saw the woman, he clung to the sides of the door. "Lord," he said. "I thought at first you were Barbara."

"I am Barbara," she answered. She had a beautiful smile. "I'm Major Barbara Killison. I'm a doctor. I understand you're sick."

"So that's the way the wind blows, is it?" he snarled. "How dumb do they think I am? Sure, I was sick and will be again. But I'm not so far out of my head that I don't know when I'm being played for a fall guy."

"May I come in?" she asked coolly. She marched straight at him. He had to let her in or else block her body. At the last moment, he stepped aside and watched her put her bag on a table, open it and take out a stethoscope. "Would you mind unbuttoning your shirt?"

"That, too? Sure, I'll take off everything. That's what they put you up to, isn't it?"

"I may have to give you a complete examination."

He laughed loudly. "Come on, Killison. Let's not be coy. I know that Old Fox Yewliss is bent on forcing the Belos from me. I know how his mind works. He submits a list of facts, or supposed facts, about my life to the Comproh. 'What says the Comproh?' he asks. And it answers that if he wants the secret, send some one who can seduce it from me. A Delilah to clip the long-haired Samson. Get a girl who looks like his wife. He'll like that; he's very much in love with her. Have her be a doctor. If all else fails, she can bat her lashes over her big blue eyes and say she'll make the sacri-

fice. She'll allow herself to be aspated and share his lonely life. Together, two against the world, they'll walk hand in hand into the setting sun and make beautiful music together. There's only one catch in the whole plan. I won't follow it."

"I wish I knew everything, too," she replied calmly.

He held out his arm, fist clenched, blue vein ready for the needle. "Go ahead, I *have* been sick. You just now caught me in one of my healthier moods."

"There's hope for you. You're certainly not apathetic. Angry people are on the road to recovery."

"Time is the only thing that will cure my anger. I have eight years to live in this mobile prison. If I decide to stick it out, that is . . ."

She shot a look from under lowered lids to see if he were bidding for sympathy. Catching it, he sneered. She wondered if he thought the glance was one of coquetry. Flushing despite herself, she took the blood sample and then walked to the table where she set up her rack of tubes and several tiny machines.

"If you want to, you may use my lab," he said. "It's very large, set up at Government expense."

"May I?" she asked.

"Go ahead. It's the last door to the left at the end of the hall."

Glad that he wasn't going with her, she said, "Thank you," and walked down the long, deserted corridor. A feeling came to her that he was watching. She sensed his eyes roving her hips. She tried to modify their sway, for she knew very well that her walk aroused men. She couldn't help it; she was born with the talent. Nevertheless, for some reason, she now felt self-conscious. His eyes were feverish, skimming the goose-pimples on her skin.

When she entered the lab, she stopped short and gasped. It was a mess—broken glass and torn books and stinking liquids littered the floor. Even a shatterproof window bore spiderweb streaks where he'd struck it. Dried blood stained one corner of it.

The damage didn't matter. She went to the lab for privacy. A flick of the toggle on the wristbox and a syllable reached Yewliss at once.

"Yew, what have you been feeding this man?"

"What?"

"Somebody's tampered with his food. It's no wonder he suffers recurrent fevers. I found enough pyretigen in his blood to send an elephant to bed."

"All right," came his deep voice, somewhat tinny through the receiver. "I could pretend innocence. I won't. The Comprob estimated that a fever would bring him even closer to the breaking point. His mother nursed him through three attacks of a fever while he was vacationing as a child in India. So I gave him an artificial temperature. It won't hurt him."

"Yew, if this gets out, you'll be disgraced!"

"I know it. Babs, don't be mad. I don't like to be dramatic—" he paused when she laughed—"but the fate of humanity depends on Ogtate. I'd do anything —even give up *you*, much as I love you—to get the Belos. Time is short; our scientists are working furiously to duplicate the Belos principle, but without success so far. No, Babs. What I'm doing—how many men you know would dare it? Remember, this is for you, too."

She shook. "That may be true, but I don't want *anyone* to violate another's free will like that. Not even for the world. Or for me."

His voice was anger-stippled. "Sure, I know it violates everything you were taught. But I'm a congenital sceptic. The stuff they injected me with never 'took'. If I have a goal, I reach it. That's the motto of my world, Callisto. A damn good thing for Earth, too. Do you realize that a large percentage of top officers of the military come from outlying satellites? They're the only ones who aren't afraid to command others . . . Never mind. No time for that. Has anything interesting happened? Do you like Ogtate?"

She cried, "I don't think I like either of you!" and she flicked off the toggle.

8

Bill Ogtate watched Barbara walking down the hall. A new, different fever ran through him. When he thought of her, the pit of his belly flamed. Breathing hard, he walked into the library, locked the door, and flicked on the wall-visor. The screen showed the pilot-room of a spaceship buried in mud beneath the floating-dock on the west side of Lemon's Island. Smith had reached it through an underground, underwater passage constructed for the use of the eccentric who had ordered the island built.

Smith, or, if you preferred, Ixtrungszb, stared at him with solid green-blue eyes. His trunk lifted, and the sidewise-grinding rows of teeth showed through his mustache. He stuck a cigar in his mouth and blew smoke-rings through the trunk, a feat the human much admired. "Bill, what's the matter?"

The man's voice trembled. "I think you're going to get your answer within the next few hours," he said.

The Priami removed his cigar. "Ah, the female is the catalyst."

"Yes. I'm going to decide, one way or the other. She'll have to leave by this morning or else stay for eight years."

Smith blew surprise through his trunk. "I, of course, am unable to judge her beauty, since I have quite different standards. I see she's affected you very much."

"It's far from being that simple. I'm weary of life. She has appeared at the psychological moment."

Smith expelled more smoke through his waving proboscis and said, "Well, Bill, I'll stick to my promise. If you decide to give the Belos to Earth and not to us, I'll not kill you or kidnap you. I'll just take back the message. But I hope for the sake of universal peace that your answer is favorable."

Gloomily, the man said, "I do too. Smitty," and turned the visor off. He knew the Martian didn't lie. He had put him under the eegie while questioning him.

As he left the library, he met Killison coming down the hall. She said nothing about the wreckage in the lab, but set her kit back on the table. He motioned toward the lab and said, "I won't weep and orate about how lonely and bitter I am. You see the external effects of my state. Language can't communicate the internal. You know, Barbara, I should hate you? I've hated my wife for a long time because she deserted me. My loneliness and my sickness drove me back to her tonight to make a plea that I knew in my heart was hopeless. I couldn't help it. I didn't want to go to her. Something picked me up by the nape of my neck and carried me there. I should hate you because you remind me of her. I don't. I'm free to reject or accept you for what you are, not for what you *seem* to be." He came closer as he spoke. When he finished, he put his arms around her and kissed her.

Barbara did not resist, for she wanted to find out how she would like it. Much depended on this, although she was aware that first kisses are often unsat-

isfactory and that it takes time to realize each other's techniques, quirks, and foibles. He had a nice mouth. Slow at first, even tender, he gradually took fire and suddenly pressed so hard he mashed her mouth. She managed to make him release her.

"A long time," he said, shaking. "A long time."

"I liked it, but I think you should exercise some control. I won't be forced. I can take care of myself."

"Right now you could," he said. "However, if you had studied my psych index, you'd know I'm incapable of violence."

"Your index says so, but there's a part of you that might be quite violent!"

He laughed. "Barbara, I won't waste any words. Will you have me from now on? You know, of course, what that implies."

"How do you know you want to be alone with me for eight years?" she replied. "We would have to stay together, you know, even if we came to hate each other. There would be no one else to go to."

He removed his hands to light a cigarette. When it glowed, he did not touch her again. He seemed to sense she did not, at that particular moment, care for it. Perceiving his delicacy, she warmed inside.

"Look, Barbara, you have been on some outlying asteroid, right? You haven't followed my life too closely. You would be surprised to learn the number of women who offered to share life with me. I carefully checked the psych index of everyone. I was thorough because I haven't much else to do. And I rejected them, lonely as I was."

He smiled at her widening eyes and said, "Sit down. Care for a drink? Brandy and a water chaser? Good! How did I know? It's easy. Yewliss, as you have gathered by now, isn't the only one with access to the Comprob. The Government allows me about anything I want, you know.

"But before I tell you things about yourself you think only you know, I want to make a confession. After I kissed you, I said, 'A long time.' You thought that tonight was the first time I'd held a woman in my arms for two years, didn't you? Well, it wasn't." He sipped from his glass, tasted the liquor on his tongue, and then swallowed.

"For a long time the Government has been shipping me women. They take the anti-asp shot, stay overnight, and leave. I've had a hundred. They all had high-sounding motives. They wanted to get the secret from me for the *good of mankind*, in the interests of peace, but they didn't fool me for a minute. All they were after was the glory, the rewards that would be heaped upon them by the worried populace. "That was until six months ago. Suddenly, I became enraged, disgusted. Those nights left me feeling nothing. Nothing. Or, rather, a deep uneasiness. Maybe that is a moral reaction, who knows? Whatever the definition, it was a definite emptiness. *Sex wasn't enough*. I had some of Earth's most beautiful and passionate women, and they left me unfulfilled. They just weren't . . ."

He looked down at his drink as if he didn't want to face her. "About that time I came to know a Martian. He was one who shared my outstanding feature, the ability to create fear. Not by any evil in him. Just by his presence. We became friends, despite certain difficulties of communication, and soon knew each other as well as might be expected. He is quite a master of the mind. He has a new slant on the psyche, perhaps because he cannot think like a human and so is more objective. I can confide in him as I never could in . . . human therapists . . . because I don't feel ashamed. He seems so non-personal, although in fact he is quite friendly and has many admirable qualities. So, while we play chess, he rids me of demons that have been riding me. The fact that I went to my wife showed me I wasn't free of her yet. But that act broke the last puppet-string. *I'm through with her!*"

"You seem a little confused," she said. She was thinking that Yewliss should check on the visor-records to find out who was playing long-distance chess with him. He might pry useful information from him. She continued, "Did you forget your wife because you think now you've found a satisfactory substitute?"

"Barbara, I've not known you long. But I'm sure there's no one like you, and I'm sure you're the real thing." He looked up from his glass. His eyes searched hers. "Barbara, all those women? Will they make any difference in your decision?"

"No. I'm not—as they say in historical novels—pure."

"Yewliss?"

"Yes, and several others."

"What about me?"

"Too short an acquaintance. I know your index, but a man on paper and one in the flesh are two different things. Tell me how you know about me?"

"How do I know you? Easy. After rejecting hundreds of offers, I asked the Comprob to find the woman I would best like. She had to be one who'd be capable of loving me, too. You fit both rôles."

"And Yewliss was also asking for a woman whose specifications happened to fit me?"

"Yes. He sent for you before I was disentangled from my wife. I put off contacting you."

"So you insulted me because you were still angry at your wife? You transferred your rage from one Barbara to another?"

"Partly. I was contemptuous, too, because the Old Fox thought he was dealing with a stupid young cock." He took another drink, then said, "Would you mind taking my temperature? I feel hot again. Comes on me suddenly."

She raised her eyebrows and reached for the thermodial. "When did you last eat?"

She was troubled. The amount of pyretigen she detected in his blood should not have been there. It should long ago have oxidized. Possibly, Yewliss had also put some fever-inducer in his liquor, but she doubted that. An excess would be serious. The General,

". . . contemplating a queen . . ."

whatever his philosophy of ends and means, did not want to kill Ogtate. The dial rose to 100 and stopped.

He took it from his mouth and said, "It always comes up fast and stays at about 100.8 for an hour. Then it quickly goes back to normal."

"When did you first notice this fever?"

"Three days ago. Right after lunch."

"Why didn't you call a doctor?"

"I felt fine between attacks, and, to be frank, I didn't care whether I lived or died." He touched the back of her hand. "I do now."

She ignored his last remark and said, "Let me think a moment." She lighted a cigarette and gazed at him. He looked bad. His eyes were hot and red, and fatigue subtly crumpled his body-fullness. The possible reactions to the pyretigen were complicated and frightening. And there were the asps, too. A visor-screen wit had called them Anti-Social Perfume, and the initials, with their association of the venemous snake, had stuck. *Bill Ogtate was the Asp.* If you came near him, you were 'bitten'.

Ogtate's identity as a true Asp would last at least eight years. During the final eight months, the semivirus, for a reason not yet determined, would literally 'kick off.' Perhaps the body becomes tired of feeding the parasite and starves them of electromagnetic power by building a powerline around them. No one knew. The asps were created in laboratory animals and would never have been applied to human beings, had not a man with a desire to control and revenge perverted it to this end.

"Any conclusions, Doc?" croaked Bill.

"Not yet. You'd better reach over for a drink. Water, I mean."

The problem was whether or not the pyretigen, also a semivirus, acted in conjunction with the asps to produce the temperature again. As far as she knew, the combination had never been put in a living body.

Another question. What prevented the complete oxidization of the fever-maker? Pyretigen would naturally combine with oxygen after a change in chemical structure.

"How long did you say the fever lasts?" she asked.

"About an hour. It goes away fast, but three hours later it returns fast."

There was something about that rhythm that should have strummed a resonant chord in her mind. She tried vainly to strike it.

"You'd better lie down," she said, rising to help him to the divan.

He shook his head. "Nothing doing. I do *not* need a nurse."

Accepting his stubbornness, knowing what was behind it, she silently took his temperature and pulse again. Then she drew out another sample of blood. A minute's work showed her that the amount of pyretigen had not diminished: *it had increased!*

He said, "All this talk, and you still haven't answered me. Will you marry me?"

Barbara kept her back to him. "I think I could. But I'm not in love with you."

"Could you be in the future?"

"What is love?"

"If you can endure eight years of living with me, without wanting to kill me or to be indifferent to me, you'll be in love. After all, we don't have to stay here. We can travel anywhere, be assured of privacy, entirely at Government expense. Eight years would fly."

"How could we travel without creating a fuss? Anyway, that does not matter. I've a question. If I promise to marry you, will you give Earth the Belos?"

"Are you trading yourself for the Belos?"

"You're sick. Otherwise, I'd knock you down for that."

"Try it. You're not as tough as you think you are, Barbara."

"*Look* at the man. Already he's quarreling."

"That was childish. I shouldn't have said it. The point is, I want you, Barbara. But I must feel you're not just a woman provided by the Government."

"My point is this. Will you give Earth the Belos? Madly in love with you or not, I still have my duty, to induce you to give up the secret."

"Induce? Seduce!"

"Anyway you call it. The Belos or me."

He stood, shakily, and turned his head back and forth. "I don't know. Maybe the fever's getting me. I wouldn't do this in my right mind." Gripping the table's edge, he said, "Barbara, promise me that, soldier's duty or not, you won't reveal what I'm going to show you."

Puzzled, she said, "I promise, provided it's not dangerous to Earth's welfare."

"This isn't."

He went into the library, closed the door, and in a few minutes returned to slump into the chair. The moment he did so, she, forgetting his behavior, jumped from her chair, saying loudly, "I've got it! I've got it!"

"I'll have the place sprayed," he croaked, smiling feebly.

She came over and kissed his fever-parched mouth. "If you can joke while feeling like this, you *might* make a good husband."

She picked up her bag and went into the lab. Not all the bottles were smashed. Her clue was the fact that pyretigen raised a fever by conserving excess heat in the body resulting from increased cell metabolism. Its action was doublefold. It oxidized sugar, breaking it down into carbon dioxide and water. Though the burning of glucose was a normal function in the body, pyretigen accelerated it. At the same time, it excited that part of the sympathetic nervous system which controlled the capillaries of the skin, thereby contracting them and lessening the blood-flow through them. The result was that excess heat was not radiated at the body's surface.

The fever-inducer, normally burned up in the blood, maintained itself in Ogtate's blood. Killison, recalling the asps' maintenance of their numbers, reasoned that they were the underlying cause for the steady level of pyretigen. Somehow, they "locked" onto the fever-stimulants and, as fast as the substance burned, produced more.

The rhythm of reproduction of the asps was followed by the pyretigen. Killison wanted to know if the pyretigen had a similar enough molecular structure, positively charged, to fasten itself onto the negative tag-ends of the asp.

Books were scattered on the floor. She searched among them and was thrilled to find the one she sought. Some pages were torn out, but among the ones left she found her information. The semivirus pyretigen did have an asp-like molecular structure.

A calculated dose of a recently developed antivirus in his bloodstream might close down the little double factories. The serum, though it started in the vascular system, could diffuse through other tissues. It was itself as dangerous as the foes it was designed to fight. But a sample of blood would show exactly the proportions needed. The numbered hosts would

tramp up and down the highways and alleys of the body, and wherever they met the enemy, they would attack. They couldn't refuse to fight, for their negative charge drew them irresistibly to their brother virus. Civil war would rage. Antivirus would meet the pyretigen, would close with it, would explode. Touching one would discharge the field of both. Literally burned, they would then disintegrate.

Ogtate's body would be a funeral pyre. It would become warm, but the ultimate effect would be cool.

As a matter of course, the discharged pyretigens would become unlocked from the asps. There would be no more fabrications by fabrications. And Barbara Killison would see to it that Bill ate no more tampered-with food.

She searched in the huge lab and found what she wanted. Her hopes were high, for there was almost every kind of substance needed. Ogtate had by no means destroyed all of the containers. Having located a tube, she returned to the big room at the end of the hall.

"Bill!" she called. "We'll fix you . . ." Rigid, she stopped short and gasped.

9

Ogtate said, "I'm sorry, Barbara. Smitty just walked in. I was telling him to wait in the library until I prepared you. I'm really sorry."

Smitty removed his cigar with the prehensile end of his trunk and said, "Believe me, Madame, if I hadn't known you were here, and I'd walked around the corner into you, I'd have been just as startled and horrified."

She recovered a little and said, "Thank you."

"Bill," Barbara said, "I'm going to pour a bunch of little thunderstorms in you. This stuff wasn't designed for the particular kind of work it's being called to do, but it should handle your trouble."

He didn't watch the needle but looked at the Priami. "Sit down, Smitty. I'm going to give you my decision now."

Smith trumpeted an undecipherable emotion. Barbara jumped and pushed the needle in hard. Bill said, "Ouch!"

"That's what I meant," said Smith. Smoking, he sat back, seemingly at ease with the world. Bill could see the abnormal pulsing of veins and, perhaps, the heart hammering under the unorthodox rib-cage. The latter, he thought, must be his imagination.

"There are four things I can do," intoned Ogtate. "One, keep the Belos to myself. Two, give it to Earth. Three, extend it to Mars. Four, allow both factions to possess it. If I do the first, I go crazy from indecision. More important, I'll spend eight years without the one woman I know I can learn to love. If you want the truth, I'm afraid to face those years without her. If I do the second, I will, I'm sure, start Earth on a downward spiral of conquest and arrogance. Earth people are not the stuff of warriors just now, but until two hundred years ago they were, and they can be again. And Smitty risked his life to sneak here and convince me the Priami aren't the all-black carnivorous monsters they're painted to be. As is evident, you can see through him. He has nothing to hide."

Ogtate sat up a little straighter. Killison asked him if he felt better, and he replied that he did.

"If I give it to the Priami alone, then the warmongers there will do to us as we'd do to them. Although I am bitter, I don't, contrary to report, hate man as a whole. I loathe some individuals and am indifferent to others. But wiping out a world because of what a small, vicious gang did to me, isn't in my character at all." He smiled apologetically at the woman. "In fact I held the Belos over Earth's head because I knew that once I gave it away, I'd no longer be valuable. Yewliss was kind enough to point that that out to me during a visor-interview, and Smitty here confirmed it. I rejected that idea, because it made me look so terribly selfish. But Barbara's appearance tonight, as Smitty said, was a catalyst. The truth of my unconscious possessiveness hit me.

"If I do the fourth, give the Belos to both planets . . . As for the traitor-stigma I'll gain, the Government can make no official actions because of the law of free will. By giving the Belos to the Priami, I'm not personally hurting anybody. Earth ships don't *have* to penetrate the Priami field. If they want to, let them do it safely, by arranging peace. There'll be social ostracism, yes. What a laugh! And eight years hence, I'm sure, events will prove me right. Chances are, I'll be in the limelight again, this time as a social lion—instead of a skunk. No matter. I don't care about their adulation.

"As for the accusation that I'll be setting up another status quo, I plead guilty. The two foes will stagnate because they'll be afraid to use interplanetary travel. They'll slide back to their former conditions of dinky one-globe states. That is, unless they achieve peace. They'll have to, because population and prosperity depend on trade between worlds. Cut off EPB transmitters and you have chaos."

Smith rose, trumpeted again and dropped his cigar. The light behind him gleamed dully through him and showed a blackish pump working *accelerando* in the grille of his chest. "I have your word?"

Ogtate straightened some more. He looked proud. This was his greatest moment. He was the unofficial emperor of the solar system; he was dispensing the fate of many billions. "The papers are on the table by your chair. They were within handreach for the last six months. I just couldn't make up my mind to tell you what they were."

As if he would at all costs keep his dignity, Smith turned slowly. When he picked up the thick packet, he almost dropped it. His proboscis blew a suspicious note. "Bill," he said.

He stopped, interrupted by a hysterical, tiny gonging from the woman's wristbox. She flicked the toggle and said, "Major Killison talking."

"Barbara!" tinned Yewliss' voice. "Drop everything and come on home. Good news! Lord, but it's good news! For all of us. For Earth and for you and for me."

"What is it?"

"The Belos field has been discovered independently by our scientists. We don't need to toady to Ogtate any more. You can forget about your sacrifice and come home to me."

Bill jumped up and screamed, "What?" and he swayed.

Barbara seemed stunned, too. Yewliss demanded several times that she answer.

"All right, Yew. I'll contact you later."

"Later, nothing!" exploded the wristbox. "I'm flying now to get you."

"You stay right there until I tell you to come. There are some problems yet to solve."

"Babs, you don't have to go through with that silly act. Lord, now I think back on it, I don't see how I could have let you go ahead."

"But you did, Yew," she replied, tonelessly. "You

"It'll be hard getting a good smoke on Mars."

know me well enough to realize I mean what I say. Don't come until I call you."

"Major Killison, this is General Yewliss speaking!"

"Man Yewliss, this is woman Killison talking. So long." She snapped the little lever.

Ogtate said, "I don't know what to say, Barbara."

Smith stepped forward and seized the man's left hand in his webbed fingers. His trunk caressed Bill's forehead with a gesture of affection. It hinted, also, of sadness and farewell.

The woman, watching him, was aware of an irrelevant thought. She had wondered in the back of her mind why he wasn't affected by the bite. Now the answer came from the dark of forgotten facts. His metabolism was based on a fluorine-carbon chain. The drifting semiviruses couldn't attach themselves to his poisonous proteins.

The Priami seemed to know Ogtate was in no mood for lengthy ceremonies. He said, "I thank you for all you've done. I respect you, Bill, and I know you respect me. I hope to see you again, and I wish you good fortune with your female. Whether that means getting or losing her, I can't say. But I wish you fortune."

Bill said in a tight voice, "Sorry you must go, Smitty. But your people will want to hear your news."

Smitty trumpeted. "I wouldn't be surprised if, when I arrived, I found my people, too, had discovered the Belos. And I will be ignored, the ignominious hero who was too late."

He faced Barbara. "I hope to visit you some day, Major. Openly."

She murmured a suitable reply.

He walked away, swinging long thin arms, then stopped and said, hesitantly, "Bill, would you do me a favor?"

"Sure."

The Priami picked up a box of cigars. "I'd like to take these home. It'll be hard getting a good smoke on Mars."

Ogtate burst out laughing and sat down. "Go ahead, Smitty. Take a dozen boxes, all I have. Compliments of the Earth Government!"

"The opening wedges in the door of peace."

He was gone.

10

Barbara put the thermodial in his mouth and felt his pulse. When she looked at the gauge, she said, "Almost normal. How do you feel?"

"Rotten. But not from the fever. I feel like the world's biggest fool."

"At least you're not a nonentity."

"I'm that, too."

For want of anything better to say, thinking she must take his mind off his sudden plunge into humiliation, she commented, "Well, you'll have no more fever, anyway."

When he wanted to know what she meant, she decided nobody would be hurt by the information. The maneuvering was over.

He cursed. "Yewliss, again! I could sue him for interference of free will!"

"You won't. Your index shows you dislike legal procedures."

He poured two double shots of brandy and gave her one. "Well, here's to the Old Fox and you. May you bear him many cubs."

"Your index also shows you often leap to conclusions."

The dark liquor sloshed over the tiny glass. "If you go back to Yewliss," he said, "I'll have nothing."

"Turn on the visor," she said.

They watched the wild celebrations of the crowds that had quickly gathered all over the world. Bill flicked the screen off.

"Poor devils, they remind me of us. They work on one problem, and halfway through the solution of the first, a second one forms."

"Life is like that," she said. Her hand touched

his for the first time since he kissed her, and she didn't take it back.

"True," he said, "but I don't feel like philosophising. Barbara, what are you going to do?"

"I don't know. That's funny, too, because I'm usually quick at deciding."

"Then you're not just going to walk out on me?"

She shook her head. "No. This is no longer a military mission. It's entirely personal. Actually, it was personal from the beginning."

"What do you mean?"

"You won't hate me? Promise?"

"Why should I? I mean, why should I hate you?"

"Bill, one of the reasons I came to you—the main one, in fact—is that I felt guilty about you. I've had that feeling for a long time. I told myself it was ridiculous—that what happened to you wasn't my fault."

"Barbara, get to the point!"

"Very well. I came here because . . . I was responsible for your being inoculated with the Asp. You see, I was one of those who created it. I couldn't help that it was used as a political weapon. When we made it, it was for experiments with laboratory animals. None of us had the slightest idea that someone would steal the virus and inject you with it."

He shut his eyes for a second. Opening them, he said, "I know. But it was a shock. I've cursed the asp inventors so many times, even when I knew they weren't guilty. And now to have you . . ."

"You can see why I came?"

He nodded, and then, as if inspired, his face grew twisted, unrecognizable and frightening. He rose, took her hand and lead her to the broad staircase that curved like a ram's horn to the second floor.

She said, "What do you think you're doing?"

"We might as well find out if we *really* like each other."

She jerked her hand from his.

"Is that what you mean by *really* liking? Do you still think I'm just one of those women provided by the Government for your pleasure?"

He sensed he had lost her. "Forgive me, Barbara. No, it's just that we have to act in some fashion."

"But that's not my idea of using your brain to solve a problem. Or using your heart, either."

They sat down again. Hesitantly, he picked up her hand. When she did not refuse it, he put his arm around her and kissed her.

"But will you ever decide? You're sure you're not trying to let me down easy?"

"After I just confessed my guilt? Quit asking foolish questions, will you?"

She closed her eyes and leaned back. He, like an automaton obeying preset stimuli, leaned over and kissed her. This time, though he had expected she would, she did not protest. She shifted a little and did not turn her head away.

At last she whispered, "Oh, if you must, Bill. If you think that's the only way. But, I think it's . . ."

Despite what she said, she held him as tightly as he held her. Her nails dug into his arms as if she were loneliness and fear trying to clutch love and courage. He pondered: what, besides his flesh, did he have to give to her? He pondered only briefly.

11

It was a bright day when Ogtate awoke. General Yewliss arrived. At the moment that Ogtate first saw him, he was not intent upon them. His fierce black eyes were fixed upon his wristwatch.

Ogtate sat up to dress. Neither man spoke.

By the time Bill was clothed, Barbara came in. Yewliss did not explode. He spoke gently, "All right, Barbara. I was worried about what might happen, so I took an anti-asp myself and flew here. I am not too surprised by what I find. I understand you might feel sorry for Ogtate. I do myself, a little."

"Don't just stand there, Yewliss, breathing like a foundered bull," Barbara said. "Events have put a different perspective on *this*." Her voice regained its normal fluid assurance. "I take it, Yew, all is forgiven and forgotten?" She held out her hand to Yewliss.

Then she turned. "Bill, I may be a fool, but I don't regret what happened before. And since I've decided we'll be a long time together . . ."

Bill wasn't looking at her. He was staring over her shoulder at the clock on the wall. She twisted her head. It was a few seconds before she realized the significance of the hands on the face.

Yewliss knew when he came, but he had said nothing. Now he rumbled, "Babs, your ten hours were up fifty minutes ago."

She turned away, shrugging. "Should I be frightened?" She went to the table on which rested her tube-rack and bag.

As if inspired by press of daring resolve, she stopped, tube in hand, and stared, red mouth gaping in hopeful wonder. "Could it be? Why not? They never tried that particular combination before. It won't be the first time an accident has shown what experiment never would." She whirled and leaped at Ogtate and seized his shirt.

"Bill, it's wonderful! And it *was* an accident! But I did it! I did it!"

The men were bewildered.

"Bill, don't you see? I poured that anti-pyretigen into you. It not only discharged its enemies, it did more. It must have released the asps, too! When the interlocking antis and gens burned, they reversed the positive charge of the asp cells. And the weakened asps drifted off and were excreted while you slept. They couldn't reattach themselves after they'd regained their normal charge, probably because the electrophoretic display accelerated the normal time for your soma's disposal of the asps. Eight years' work in ten hours! Oh, I don't know exactly. We can find out in the labs, later. Now, you're free, Bill. Free! Nobody will ever run away from you!"

Yewliss and Ogtate looked at her and then at each other. Their eyes said that she was very beautiful.

Yewliss roared with resigned laughter. They waited until he'd quit laughing. Then Barbara said, "All's not well yet. The war isn't won. We discovered the Belos; the Priami *may do so independently*."

Ogtate shot her a grateful look for keeping confidence of his concession to the Priami.

"You're right," the General said. "We're at a standstill. The only way we'll find out if they own it, too, will be to send a ship through. If they have it, the ship goes up in a blaze of energy."

"Then what?" asked Ogtate, staring at the woman as if he were seeing a new creature.

"Then—static. The end of interplanetary travel. Babs, you'll get new orders that'll keep you on Earth. I promise that."

"I'd hoped so," she replied. "Bill, what about you? This development puts us on a new plane. Before, I knew where we stood. Now, I'm confused."

Ogtate frowned. Then tidily, as a good husband should, he replied: "I'll have to arrange for moving certain things from this island."

the TIME CYLINDER

by **EANDO BINDER**
(Illustration by Paul Cooper)

At the 1939 World's Fair in Flushing Meadows, a time capsule, containing representative samples of our cultural and technological achievement, was buried. So carefully thought out were the enclosures that even a copy of a science-fiction magazine was placed in the capsule! Our descendants may some day examine the contents of this capsule with interest and astonishment. But suppose we were to find a time capsule. What might it contain? What civilization could have buried it? Eando Binder, popular author of past years, returns to science-fiction to explore this fascinating theme.

Eando Binder
The name, Eando, once alluded to the brothers Earl and Otto Binder (E-and-O). Long ago the team split up and Otto O. Binder carried on the famous name. Binder has returned to science-fiction after an absence of almost ten years. In 1941 he was the most popular science-fiction writer in the country.

"AND you uncovered the time capsule with your plow?" asked Stoddard.

The farmer nodded. He shifted his chew of tobacco in his cheeks, astounded at all the furor this discovery had caused. "Out in my east forty I found it," he said. "Just cleared that piece. It was timber and scrub land before. My plow hit something hard just under the ground. Figured it was a rock so I scooped away dirt and there it was—or the top of it—that thing. What did you call it?"

"A time capsule," Stoddard said, trying to control his feverish excitement. "Look at it. What else could it be? A long-lasting, bronzelike cylinder twenty-five feet long, completely sealed. Very much like the others we've buried at times for future ages to find. The Archeological Institute sent Jackson and me to investigate your report of it. We thought of course—no offense—it might be simply a wild story."

Jackson also was bristling with excitement. "What a find! Look how it's tarnished and encrusted with mold. A record-crypt from some long past age!"

It lay there, a riddle wrapped in tawny metal. The farmer himself had hitched up his tractor and dragged it free of the ground. What strange, unknown, past civilization had buried this record of itself, fated to be found in 1953?

"The papers will go crazy when the news gets out," Stoddard prophesied. "This is headline stuff." He whirled to the phone. "Time's wasting. I'll tell Professor Beatty at the Institute to send a truck to haul it there. Then for the grand opening. How far back does this date, Jackson? A thousand years? Ten thousand? Who knows?"

But already Jackson was staring at the time capsule with puzzled eyes, vaguely sensing that the answer promised to be more astounding than they yet dreamed . . .

Sirens wailed through the city streets, a few hours later. An eager crowd already lined the path of the big trailer truck as it hauled the huge cylinder, flanked by its police escort of motorcycles, to the Archeological Institute.

Extras already proclaimed it in their headlines as—TIME CAPSULE FOUND FROM DAWN OF CIVILIZATION. Radio announcers were hardly less reticent nor more accurate with "Ancient record-crypt may be a million years old." Camera crews from TV networks were at hand, recording everything on film as the giant capsule was carefully maneuvered into the back warehouse of the Institute. Nothing could so fire the imagination of the public as finding something from antiquity, throwing light on Earth's past history.

It was like the discovery of King Tut's tomb all over again, only on a grander scale. Finally the police succeeded in waving the last of the crowd away and the warehouse doors closed on the time capsule.

Professor Beatty, director of the Institute, stared at it with shocked wonder, as if somehow it had no right to exist. "We'll drop everything," he announced immediately. "Even that sorting of Mayan pottery. We'll get at this tomorrow with our whole crew."

Stoddard's face fell. "Must it wait till tomorrow? Professor, how about me and Jackson? Can't we get right to work on it? Why waste a whole day?"

Beatty had to chuckle. "That thing has been buried for untold centuries perhaps. Millions of days. What would one *more* day matter? All right, go ahead, you two eager-beavers. But you're getting the dirty work, scraping off that mold."

He left, smiling at their youthful enthusiasm. He, too, had been that way, long ago, when he came across his first find of Neolithic arrowheads.

Left alone, Stoddard and Jackson went to work with panting haste. Surprisingly, it was an easy job to chip off the hardened mold and clean the surface. Often it took days or weeks to extract ancient relics patiently from fossilized mud. This bronze cylinder

"An anti-gravity motor"

began to gleam bright and clean under the final hand polishing, in less than six hours.

"Funny," Jackson muttered. "You'd think something buried for any really long period of time would be far more corroded than this. What if this thing is a *hoax?*"

Stoddard yelped at the word, as if it had stabbed him. "Don't say such a thing, Jackson."

But Jackson was persistent with that gnawing doubt. "I'd swear it looks as if it had rested in the ground only a short time. Somebody might have buried it just a few years ago as a practical joke. People have done such things, you know—remember the Cardiff Giant?"

Stoddard had recovered his excitement. "Always the skeptic," he chided. "Listen, what if the makers of the cylinder knew great metal arts? What if they made an alloy resistant to the ravages of time? See? —that would explain it."

"Sure, sure," Jackson agreed with a twisted lip. "That's nice and glib. For a so-called scientist, Stoddard, you have a most naïve attitude."

"May I return the compliment?" said Stoddard, dripping honey from his voice. "You're of the hard-headed school, Jackson. Just a shade short of the lard-headed school."

Thus they worked on as a team, smoothly, oiled by mutual stabs of sarcasm flying back and forth. The casual listener might infer they were bitter personal enemies. But the sensitive observer would see their staunch friendship. Their stinging insults were really words of respect and admiration, merely couched in reverse semantics. If they ever said anything *nice* about each other, it would be the danger signal that their friendship was precarious.

"There's something peculiar about this whole thing," Jackson said seriously. "What past age could turn out a tooled cylinder like this? Certainly not the Egyptians with their clumsy stone pyramids. Nor the Sumerians with their crude clay pottery. And not any later age like the Greeks and Romans, who were great thinkers but poor doers. That metal container is as good as any we could make with modern technology. *What* blasted *past* era could duplicate it?"

"Isn't that what we're trying to find out?" Stoddard's tone was ironic—but also puzzled. "Yes, what unknown artisans did whip that thing together? How about it, Jackson—shall we open it up now?"

"Professor Beatty didn't give us permission to go that far," Jackson said hesitantly.

"He'd probably be sore if we did," agreed Stoddard. "And how he *can* rip you up and down when he's in a rage. We'd be hauled on the carpet and tongue-lashed. We'd be utter fools to open it."

"O.K.," said Jackson. "Let's open it."

They grinned at each other like two conspirators.

"Hmm. If we *can*," amended Stoddard, feeling his way along the smooth cylinder. "*How* do we open it? The thing has no screw top, like the time capsule buried at the New York World's Fair in 1939. It has

no doors or openings of any kind. Solid, smooth, from end to end! Are we supposed to blast it open with dynamite? Or use an oxy-acetylene torch?"

Jackson went over it inch by inch, but it was getting dark now. "I'll turn on the lights and we'll give it a more thorough going-over. It must have *some* kind of opening, or means of getting inside."

But Jackson's finger paused at the light switch, at a sharp word from Stoddard. "Wait, Jackson—give a look. I don't think we need lights. It *glows* in the dark!"

Eerily, it was so.

As the gloom within the warehouse deepened with the fading light of day, the time capsule began to glow. Brighter and brighter it shone, until it was gleaming all over with a soft rosy light, revealing its every contour perfectly, by itself.

"Weird!" breathed Stoddard, caught by the wonder of it. "Somehow they incorporated its own light-giving mechanism within the capsule. Maybe to make *sure* it would be found some day, or for that matter, some night. It would send out light if the least portion of it were uncovered from the ground. But figure out how it lights up like that, Jackson—all over, uniformly. Radioactive principle?"

Jackson was already there with the Geiger counter, a standard item with archeologists who use radioactivity as a yardstick to measure eons of time. "Not a peep from the counter. No radioactivity."

Stoddard was more baffled.

"No sign of luminous paint, or phosphorescent coating. Maybe, Jackson—just maybe—that metal is somehow excited by *cosmic rays!* They stream down on earth all the time, as they did a billion years ago, and as they will a billion years from now. It would be the one sure way of making the time capsule self-luminous for all ages to come, to the end of time."

"Cosmic ray luminosity," echoed Jackson scornfully. "That is in the category of scientific wizardry. How do you think up such fairy tales, Stoddard? It may have happened by sheer accident, as well. Rotting stumps become luminous too. Or peat, buried in the ground. If you ask me, this may be a big hoax. It doesn't add up right, somehow."

"You're suspicious," Stoddard muttered, "even when two and two make four, right in front of your eyes. If we could only open it, we'd find the answer. But I've gone over it twice. It's still like the unbroken shell of an egg—"

He stopped. They froze.

A sound came from the enigmatic cylinder. A soft slithering sound. As they stared in paralyzed fascination, they saw the unbelievable. Three holes popped open by themselves, in the side of the capsule, and three rods of metal extended themselves silently. Invitingly.

Stoddard stuttered: "The solid metal softened and opened by itself, letting out levers."

"Levers?"

Stoddard pointed. "What else? Look, numerals on the knobs of each. The first is marked with a simple Roman numeral I. The second II. The third III. So we use the levers in that order. A half-witted ape could figure that out."

"Glad you did." Jackson grinned. "All right, go to it."

Stoddard moved the first handle, holding his breath. A low hum rose within the capsule. He waited, then moved number II. The hum changed to a whirr of oiled parts intermeshing. Number III resulted in a soft swish . . .

The door of the time capsule opened before them.

It was a large, round flap that miraculously detached itself from the seemingly solid metal and swung wide. From the inside came a rush of musty dry air or gas, as if the interior had been under pressure.

"Helium, no doubt," Jackson said. "An inert gas, preserving things timelessly, without harm. We sealed many of our relics in helium gas, in our own time capsules."

Stoddard peered in. The interior too was lighted brightly and automatically. It was crammed with preserved items.

"Still a hoax, Jackson?" Stoddard needled. "A bunch of clever junk whipped up by some practical joker?"

"Why not?" replied Jackson. "That's more logical than expecting them to be relics of a great and unknown civilization of Antarctica or wherever. Nevertheless, one of us may get a big shock."

Stoddard's eyes were glowing.

"Jackson," he said eagerly. "What an opportunity for us. You and I are the two youngest members of the Institute. Mere apprentices, so to speak. Beginners. Neophytes. But what if we pinned down the origin of this amazing mystery *tonight?* Before Beatty and Henderson and Povkin and the other big guns take over? What a deal for us! But that would mean working through the night, unpacking the capsule. Are you game, Jackson?"

"That," said Jackson, "is perhaps the most silly question asked since the beginning of the cosmos. Who could sleep anyway, thinking about such an exciting riddle? I'm with you. I can just picture their faces tomorrow when we tell them exactly where the time cylinder came from. That is, if luck is with us. Let's get cracking."

In dead silence, Stoddard took the relics out and handed them to Jackson. There was a large, cleared space on the floor of the warehouse, and Jackson carefully laid the items in neat rows.

The two young archeologists were panting in sweat in their hurry. But they were breathless from more than their labors. Through them tingled the thrill of entering the spirit-haunted tomb of an ancient Egyptian pharaoh. Or it was like finding the fossil bones of some hitherto unknown species of mankind. Or the wreck of a spaceship or flying saucer. All these things and more.

The treasures were books with metallic leaves, printed in an unknown language. There were photographs with a vividly three-dimensional illusion. There were samples of plastic clothing that seemed utterly rip-proof, stronger than steel yet lighter than down.

Item by item piled up, unbelievably.

"All the paraphernalia of a magnificent civilization more advanced than *ours,*" Stoddard gloated. "Well, Jackson? Is this still a spurious hoax spawned in the twisted mind of a guy playing it for laughs?"

"Why not?" Jackson returned stubbornly, but with an uncertain air. "I want positive proof to the contrary."

"You've got it," Stoddard sang, holding up photographs of startling detail. "Scenes on other worlds! One of these has a canal, like Mars would have. They had space ships and interplanetary travel. When have *you* been to Mars lately, Jackson?"

"Hollywood," said Jackson, "can make better sets than those. Those scenes prove nothing—not to me."

Stoddard let out a triumphant yell, as he took

out what appeared to be a small mechanical model of a spaceship. He touched a tiny stud on its side. It hissed and leaped out of his hand.

It spun up toward the warehouse rafters at blazing speed. Then it turned as if sensing the roof against which it might crash, swooped down like a boomerang, and wheeled in wide circles over their heads. Finally it slowed down and came to a halt . . .

In mid-air!

"I'll be a Neanderthal!" Stoddard gasped. "Do you know what that is, Jackson? Nothing less than an *anti-gravity* motor. Look. There it hangs in thin air!"

"Anti-gravity?" Jackson gulped.

Stoddard had no mercy. "Oh nonsense, Jackson. Your version of the truth is that some crackpot spent a million dollars to develop anti-gravity, and then stuck it in this time capsule so he could laugh up his sleeve at us."

Jackson broke down. "You win, Stoddard. I withdraw my sadly shattered hoax theory. But what's your theory? Did the Egyptians have such a miracle of science? Or the Dravidians? The early Mongols? Or any dead civilization we ever heard of?"

"No, none we ever *heard* of," agreed Stoddard. "If only we could pin it down . . . Ah!" He pulled something else out of the time capsule. "This gadget is unmistakably a *movie projector*."

It was shaped like a modified movie projector of compact size, but with no connecting cord. "How do we run it?" Jackson puzzled. "How do we feed it current?"

Stoddard pondered and then pretended to kick himself. "What asses we are. Everything else is self-contained, so this must be. It probably has its own built-in power system, too. I press this button."

With a buzz, the machine came to life, casting pictures before their eyes, in dazzling grandeur."

"How do you like that?" Stoddard grunted. "We don't even need a screen. It builds images in *thin air*."

They watched in silent wonder. It was all like fairyland. Arabian Nights. Alice in Wonderland. Magic.

The scenes were fantastic, of towering cities spanned with a network of spidery ramps, of stratosphere rocket liners, and robot workers, and spaceships cleaving among the stars.

Jackson spoke in a hush. "Stoddard! It's all like a dream. It can't be real!"

Stoddard glared back with a laugh, but then his face became serious. "I feel like somebody hit me on the head too. It's all so incredible and yet—listen. A voice!"

A man's face appeared in the mid-air "screen." His clothing was odd; he had a flowing mantle at his shoulders. He wore a jaunty feathered hat. He was evidently a commentator, speaking in rapid-fire accents, no doubt telling of his own amazing civilization. They listened for a long moment.

"What is it?" demanded Jackson, impatiently. "Don't hold out on me, you idiot. Is it ancient Greek? Phoenician? Syrian? What?"

But Stoddard's face was stunned, more stunned than at any time before, as he strained to understand the staccato voice.

"No. It's just—just *gibberish*, Jackson."

"What—even to *you?*" Jackson was truly startled. "But you're a dead-language expert. You could even recognize spoken Sanskrit, the granddaddy of all language, couldn't you?"

"Yes," admitted Stoddard matter-of-factly, without conceit. "Even if it were Sanskrit spoken with a lisp by a Neanderthal man with an Irish accent. I should understand a word here and there, no matter what fossil language it is. It's the *root* words that count. But I don't understand a thing, Jackson. Not a syllable. Not one syllable, Jackson."

Jackson spoke quietly, in awe.

"That makes it *completely* fantastic."

"You can say that again," exploded Stoddard, pacing the floor. "Sit down, Jackson. There's only one answer to this. There was an Ice Age circa 25,000 B.C., wasn't there? If a civilization existed *before* that, it would have been wiped from the memory of man. Therefore, I submit that the voice we hear was first recorded more than 250 centuries ago!"

"Impossible," spat Jackson instantly. "Civilization on Earth that long ago? That's in the never-never category of Atlantis and Mu and all such unproved rot."

Stoddard spread his hands.

"That's the only possible answer, Jackson. Just think, we've stumbled on something sensational. Something that will blast the roof off of archeology and all related sciences, here in staid old 1953. What else can it be but a *Pre-Ice-Age* civilization?"

"Impossible," said Jackson again. "Impossible." "Is that the only stupid word you know?" Stoddard sneered. "Why couldn't there have been such a civilization, ground under by the Ice Age glaciers?"

"Impossible," Jackson reiterated firmly. "Let's be sensible, Stoddard. It just doesn't *fit*. We've found evidence of Neanderthal and Heidelberg and Piltdown man, and other such rudimentary cultures as far back as 500,000 years ago. How could this inconceivable, grade A culture pop out of a clear blue sky in the middle of that Stone Age era? It's like finding out they used the atom bomb in Medieval times."

"All right," Stoddard improvised. "Then it was *prior* to 500,000 B.C."

"Impossible," Jackson frowned. "How ridiculous can you get? We've found fossil bones of dinosaurs from millions and millions of years ago, perfectly preserved. Why not fossil remains of that hypothetical race and civilization? Again it fits like a square peg in a round hole—like the hole in your head."

Stoddard skipped the chance for a brisk and delightful exchange of insults. He was desperate now. "So it's a civilization that wiped *itself* out—with atom bombs for instance—leaving absolutely no traces."

"Again impossible," Jackson snorted. "Even if you turn all cities into junk with bombs, who takes away the junk? Impossible."

"If you say that word once more—"

"Inconceivable, then," Jackson drawled, with mock fright. "You're a flawless idiot, Stoddard, talking like that. If they ever dig up your fossil skeleton in the future, how will they ever explain the *wooden* skull they find? Once and for all, it's inconceivable—incomprehensible—incredible—unconscionable—take your pick of synonyms for impossible—for *any* past civilization to vanish from this Earth without a trace."

Stoddard looked at the bronze capsule, glinting in its own mocking radiance, almost with hate now. "I wish we'd never found the thing," he growled. "Do they take good care of you in insane asylums? What *is* the answer to this riddle?"

Jackson ventured no answer. She was sunk in deep perplexity.

"The worst of it is," sighed Stoddard, "there goes our bubble of fame—poof! And we were going to

amaze Beatty—and the world—with our brilliant deduction of the time capsule's origin! We might as well give up and turn in."

It was close to dawn now.

But Jackson, face aglow with inspiration, now fiddled with the movie projector. "This stnd. I guess that turns it back to the beginning. And this other stnd—"

Soon, the formerly heard enigmatic voice filled the air again, but at a lower pitch, almost in a dragging drawl.

Stoddard sat bolt upright, face thunderstruck. "Listen, Jackson. I can understand him now—vaguely, that is. What did you do besides starting the film from the beginning?"

Jackson was excited now. "Just on a hunch, I *slowed down* the gadgets with this other stud. The pictures are in slow-motion now. And the voice—yes, now we can make out some words."

They listened patiently for a long while. Stoddard shook his head, not getting enough of it to make sense. But Jackson seemed to understand it.

"What's it all about?" pleaded Stoddard. "Do you get the drift of it?"

Jackson nodded, speaking in a low, tense voice. "It's a queer story, Stoddard. The queerest story ever told since the creation. Use your imagination to fill in the gaps. Think once—picture a great and glorious civilization such as the one that buried this time capsule. Think of them coming to—*the end of the road.* That's the commentator's reference, as I got it, to some kind of *blight.* A frightful blight that wiped out their race, one person after another."

Jackson paused, and went on sadly. "Even their superb science couldn't halt the blight. They faced oblivion. A blank future, in which their world would be lifeless—barren—for the blight attacked all living things, all animals and plants. Their world was stripped, denuded of all life. Tragic . . . horrible . . . ghastly."

It was a moment before Jackson could go on.

"But they wanted to leave a record. They wanted *someone* to know about them. Their place in history. Their niche in the universe. They didn't want to pass on into eternity without leaving some marker behind. Yet it would do them no good to just bury a time capsule on their world, for a future age to see. Because—the cosmic irony of it all!—*there would be no future age!* Don't you get it now, Stoddard?"

"Yes," breathed Stoddard. "Sure I get it. They were from *another world!*"

He stopped as if startled at his own words, then went on in an excited rush. "They couldn't bury a time capsule on their own world, because there would be no future beings to dig it up. So they migrated through space—those pitiful few that were left after the ravages of the blight—and buried it *here on earth.* That accounts for the lack of remains of their civilization—it never existed here. And did you notice when the speaker turned his head once? It bulged. They had maybe 25 per cent bigger brain capacity than we. Obviously not *homo sapiens,* but people from another world, with no future ahead. That's perfect now—perfect!"

"Perfect," agreed Jackson wearily. "Perfect *rot.* Their language—why did *I* understand it, as well as I understand you? Those people were humans with larger craniums."

Stoddard held his breath.

Jackson spoke slowly, measuring each word carefully, knowing in awe that it was the most dramatic revelation of all time.

"All previous time capsules were buried for a *future* age to find. But with their superb science, using time-machine mechanisms, these humans sent their capsules into the *past.*"

Jackson finished in a whisper.

"That time capsule is from our own human race, changed only by evolution—from One Million A.D.—from the *future!*"

Stoddard gasped.

Two thoughts hit him like jolts of lightning. "A *time* capsule—*literally.*" Then his voice turned grim and sad. "The human race *ends there* . . . a million years from now . . . finis . . . *Here lies the last man . . .*"

He recovered himself and grabbed Jackson in his arms, embracingly. "Jackson, you genius! We shake the world after all. But how did you suspect it was *future English,* streamlined and speeded-up, as in all evolution of language?"

"My stupid Darling," said Helen, "Haven't you ever heard of *feminine intuition?*"

STRANGER THAN SCIENCE-FICTION

We All Live In The Past

IT IS well known that the average planet-dweller views coming changes—even if he is convinced of their coming—with suspicion and alarm. Change disturbs most people, because they know that it often means social and economical upheaval.

All this is not surprising. Man resents the future unconsciously because *nature has condemned us everlastingly to live in the past.* We never perform an act in the "present."

Our fastest reflexes are already old when we perceive them. Every gesture, even the blinking of an eyelid, is in the past. By the time *any* act of ours has become conscious to us, it is already a fraction of a second old—our nerve reaction is comparatively slow, and it takes an appreciable amount of time for any physical act of ours to penetrate the conscious.

Look at your watch—*you see only what time it was,* not what time it *is!* Even with light moving at 186,000 miles an hour, it takes a small fraction of a second for the watch image to reach the retina in your eye. Then there is a much longer time-lag for the light impulses to be translated into electricity, which then travels through the optic nerve to the brain before you are made aware of what time it *was* when you looked.

Even such simple acts as shaking hands, tasting foods, listening to music, smelling perfume—*all are in the past* from ⅛ to ½ second before you are conscious of the impression! Look at the sky—you see the moon as it *was* nearly 1¼ seconds ago, the sun as it *was* over 8 minutes ago! The *nearest* star as it *was* four years ago!

And that is probably the chief reason why Science-Fiction enthusiasts like to roam in the future . . . it is exhilarating to get away from the dead and gone past . . . *H.G.*

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Rapid Wonder Plants

by Dr. GUSTAV ALBRECHT

It is difficult to grasp the great variety and strangeness of many of the world's plants. There are plants which move with extraordinary speed, such as the Venus fly-trap, which catches small insects and animals, and the mimosa, which drop their needle-like leaves with astonishing rapidity when one part of the plant is touched. Several plants show surprisingly fast growth, so fast in fact, that you can watch their progress with the bare eye. How fast can plants really grow? This article of Professor Albrecht will provide you with much food for thought.

Venus Fly-trap

Mimosa

Mushroom

THAT certain plants act rapidly, like animals, to capture food or evade enemies, seems less strange when we remember that plants and animals have common ancestors. In the creepy pre-cambrian times, some half billion years ago, there was no distinction between these forms of life, and even now many organisms exist which are at the same time plant and animal. The *euglena*, for example, contains chlorophyll with which it synthesizes sugar from carbon dioxide and water, as all higher plants do. It also moves about, catches things, and eats them with its mouth, like an animal. This sensible arrangement was sacrificed to specialization, during evolution, and most higher plants are now unable to move about or catch food, while higher animals are now totally dependent on plants or other animals for their food supply.

It is regrettable that the versatility of the *euglena* is lost in higher organisms. Consider, for example, the advantages if we possessed chlorophyll say in our hair. We could have lunch by merely taking a sun bath!

But here and there we find plants which emulate the animals, some actually catching and digesting insects, others moving rapidly to protect themselves from attack by animals. The rapid overnight growth of mushrooms is well known, and the Fly *amanita (Ammita muscaria)* poisons flies sitting on it, as well as an occasional Russian eating it.* But it apparently kills flies out of pure malice, and derives no actual sustenance from them. The case of the carnivorous plant, Venus' fly trap *(Dionaea muscipula)* is different. The leaves of this plant are modified into traps resembling jaws with teeth. When insects alight upon this leaf, the jaws close, trapping and then digesting the victims, thus supplementing the plant's drab diet of dirt and carbon dioxide. The Sundews *(Drosera)* act similarly with gooey tentacles which enclose about insects.

In the case of the amazing mimosa plant of tropical America, if one leaf is touched, every leaf on the plant instantly folds up and droops, perhaps as a protection from attacking animals, who lose their appetite as a result. The tendrils of climbing plants react to contact within a minute or two, twining about whatever affords a hold, much as an animal's fingers grasp a support. The Century plant *(Agave)* sends its flowering stalk fifteen to thirty feet into the air in two or three weeks, taking its flowers and fruit high above the reach of animals.

While animals have developed muscles to produce rapid contraction, a sort of coagulation of protein molecules as recently shown *in vitro* by Szent-Györgyi, plants respond by changes in turgor, i.e., osmotic pressure within their cells, the impulse moving through the sieve tubes of the plant to change the solute concentration, much as nerve impulses travel through the neurones of an animal. This impulse has a measurable electrical concomitant, and the plant loses its motive power by

Gustav Albrecht

Dr. Albrecht is a member of the Department of Chemistry, Taft College, California. He is a noted writer of scientific articles.

* The allusion to the fly *amanita* and the Russians should perhaps be explained. A Czar of Russia, as well as numerous other Russians, died from eating this mushroom, which is prized in that country for its narcotic effect, said to be similar to hashish. They also prepare an alcoholic beverage with the mushroom. (See Nina Marshall's *Mushroom Book*.)

application of anaesthetics, much as in the case of animals. While animals have worked out a more efficient chemical device in muscle proteins and neurones than plants, with osmotic pressure and sieve tubes, it is conceivable that, given time, plants will move as fast as animals. A tree which could swing its branches about at a lumberman, would be a formidable opponent. And so would a large Venus' fly trap which could snap at you like a lion. But unless they could also develop a sieve-tube brain, men would undoubtedly quickly outwit them.

The above are all well known plants which can be found described in any good botany text. The following account of the *Schuss-yucca*, which I recently described in SCIENTIFIC MONTHLY (October 1952), is in a class by itself!

THE SCHUSS-YUCCA*
(Yucca Whipplei, var. Schuss)

ONE of the most amazing, and still unexplained, phenomena in botany is the *Schuss-yucca*, a rare variety of the chaparral yucca *(Yucca Whipplei)*, which occurs here and there about Chilao Flat in the San Gabriel Mountains north of Pasadena, a locale noted for its queer flora and fauna. The normal variety of Yucca Whipplei grows for many years as a hemisphere of sharp and awesome spines (Spanish bayonet); then some spring day a large shoot rises ten to twenty feet in a period of two or three weeks, blooms, and dies. The Schuss-yucca of Chilao Flat does this in a matter of minutes or even seconds! (See photographs.)

Although described in a brief note in Liebig's *Annalen* (1853), the first thorough investigation of this amazing plant was made by the eminent German botanist Professor Ferdinand Grünspann, who visited Chilao Flat, riding a burro, in the spring of 1890, and who devoted Volumes 13 and 14 of his exhaustive twenty-volume work, *Handbuch der Yucca (Leipzig: Schmutzig-Verlag [1893]*—now out of print and hard to find)—to a description of this remarkable variety of the chaparral yucca. In spite of Professor Grünspann's reputation and careful research, his observations on the Schuss-yucca (a name he himself applied to it from the German *Schuss*, "to shoot up"), were not credited by contemporary botanists, who considered it a hoax (*zum lachen*). Although most of the professor's work was undoubtedly accurate, he apparently let himself be taken in by certain tall stories of the Indians, one tale in particular doing much to discredit his whole study. Grünspann tells of the Spanish desperado and cattle rustler Vasquez being impaled in mid-air by a Schuss-yucca while he (Vasquez) was jumping over the plant. This story possesses undoubted charm, but it is probably a canard. The Schuss-yucca does shoot up with amazing rapidity in a matter of seconds, but the shoot is soft, like a giant asparagus, and is frequently eaten by deer (which can be seen waiting about near plants that they somehow know are ready to sprout); hence, it could not reasonably be expected to harm a full-grown Spaniard.

This story, and the lack of imagination common at that time, combined to discredit Professor Grünspann. It is said that the professor's dying words were "*Es schiesst doch!*"—reminiscent of Galileo's famous remark some centuries earlier, "*Eppur si muove!*" But rumors about the Schuss-yucca, which the natives picturesquely refer to as the "Jumpin' Yucey," have persisted about Chilao Flat. One rumor originated at Mount Wilson, a few miles to the south, from an astronomer who was fooling around with the 100-inch telescope between exposures of the planet Mercury, and another from a skier who had got off his course in a *slalom* race down Mount Waterman.

Since I had myself seen and photographed another queer yucca in this area last year—*Yucca Whipplei*, var. *bifurcata* (mihi)—(SCIENCE, 115, 219, 1952), I determined to investigate the Schuss-yucca, and if possible bring back incontrovertible photographic evidence.

My model and I, laden with cameras and a fifth of antivenom (the rattlesnakes, too, are said to be unusually swift and accurate at Chilao Flat), haunted the region for days. We were guided by the deer, whose uncanny instinct tells them which yucca plants to watch, and we were finally rewarded for our perseverance, as the accompanying photographs show. I used an automatic Rolleiflex, taking the photographs at one-second intervals, and although the exposures were only 1/100 of a second, there is little blurring of the fast-moving sprout. The amazement on the face of the model, who was somewhat dubious of the whole affair, is clearly evident.

It is somewhat sad that cameras were not as well developed in Professor Grünspann's time—he might have died a happier

* *Note.* The following article on the *Schuss-Yucca*, by Prof. Albrecht, is reprinted by permission from the SCIENTIFIC MONTHLY, Washington, D. C. (October 1952). Mr. H. Gernsback's letter, "Recent Researches into the *Schuss-Yucca*," is also reprinted from the SCIENTIFIC MONTHLY (November 1952).

Series of five photographs showing remarkable growth of the SCHUSS-YUCCA plant in the astonishing short time of five seconds!

. . . one second . . .

. . . two seconds . . .

man. It is also regrettable that scientists as a class were so skeptical then. Scientists today realize that anything is possible, whether Schuss-yuccas or extra-terrestrial flying saucers—particularly when reported by trained and reliable observers and accompanied by good photographs.

RECENT RESEARCH INTO THE *SCHUSS-YUCCA*

Gustav Albrecht's account of the Schuss-yucca, which appeared in your October 1952 issue, was read by me with considerable satisfaction. As a long-time student of this interesting plant, I should very much like to bring the record up to date. I have at hand a copy of the *Handbuch der Yucca* (Leipzig: Schmutzig-Verlag [1893]). Apparently Dr. Albrecht had not seen the second edition, *Handbuch der Yucca, illustrierte zweite Auflage* (Leipzig: Schmutzig & Dreckig-Verlag [1913]). It seems that some time in 1910 Schmutzig Senior died. The old firm was taken over by his son, who subsequently associated himself with Herr Dreckig, and the Verlag became known under the new name shortly before World War I.

The second edition of the *Handbuch* contains quite a good deal of new information, of which the following is of some interest. Several French scientists had read Professor Grünspann's twenty-volume introduction to the study of the yucca, and in 1911 two of them set out to verify the Schuss-yucca phenomenon. These two eminent botanical researchers were Cyprien Lablague, of the Sorbonne, and Aristide Gaillard, of the Collège de France. They reasoned (accurately) that if deer could instinctively divine which yucca plants to watch, other animals might do it even better. They thought immediately of the pigs that had been used for centuries by French peasants to locate truffles (*Tuber melanosporum*) in the Perigord region of France (see Truffle, *Encyclopaedia Britannica*, 507 [1943]). It is well known that these especially trained animals have such an acute sense of smell that they can unfailingly scent the subterranean tubers; it is claimed that the pigs squeal loudly the instant they come near the underground plant.

With the aid of several of these pigs, then, the French botanists observed and photographed many Schuss-yuccas, completely vindicating Professor Grünspann. In the last *Handbuch* numerous photographs of the plant in action are reproduced. These are not as good, however, as those of Dr. Albrecht, who had the advantage of being able to use a live model and streamlined modern photographic equipment.

Messieurs Lablague and Gaillard also added some most interesting new findings, which would seem to point to the real reason lying back of the astonishingly fast growth of the yucca. As mentioned by Professor Albrecht, the Chilao Flat region is heavily infested with rattlesnakes (*Crotalus atrox*). The French scientists were able to ascertain that the rattlesnake invariably seeks out a yucca before shedding its skin. In its struggles, it takes firm hold of the yucca roots and shakes off the old skin. During this process, the snake inevitably bites into the roots, and some of the rattlesnake venom is injected into them. The French team made the further discovery that the venom contains small percentages of the powerful enzymes, hyaluronidays, and hyaluronites. These are considered to be the chief reason for the extraordinarily rapid growth of the Schuss-yucca.

This year, while I was in California, I happened to mention the matter to two Stanford University electronics physicists, and we decided to explore the subject further. Accordingly, we designed a millimeter-wave radio receiver, connected to a rotary search radar. On location we found that, with the radar antenna revolving, we frequently got blips on the cathode-ray screen from various directions, but always pointing to yuccas. Preliminary computations, based on 98 responses (discrepancies in two observations are still unresolved), have led to the tentative conclusion that the yucca plant, *24 hours before it starts to shoot*, actually sends out impulses on a wavelength close to 60 kilomegacycles. Instrumentation thus promises to provide a more scientific predictive and observational method than the use of deer or pigs, because the observer has 24 hours in which to set up photographic equipment near the plant before it starts to shoot.

The preceding account is only a preliminary report. Final results will be made known in about a year, after further scientific data have been recorded and analyzed.

Hugo Gernsback
Member, American Physical Society
Member, American Association for the Advancement of Science
Radio-Electronics, *Gernsback Publications, Inc.*
New York

. . . three seconds . . .

. . . four seconds . . .

. . . five seconds . . .

". . . lightning burned along the wires . . . we saw an apparition."

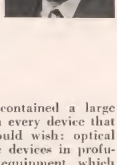
THE OTHER SIDE OF ZERO

We know very little as yet about temperature in general. How high up the scale can we reach? How low can we possibly go? No one knows. There seems to be no upper limit to temperature, which may well run into millions of degrees. On the other side of the scale, scientists for a long time have talked about absolute zero. But what is below absolute zero? *Theoretically, it is possible to reach 273.15 degrees below zero F, but is it possible to go lower?*

Professor Donald H. Menzel, Acting Director of the Harvard College Observatory, has approached this problem from an entirely new angle. To the best of our knowledge the idea has never been used in science-fiction before. We are certain that our readers will enjoy this most intriguing story, written with unusual skill. It will hold your attention from beginning to end.

by Prof. DONALD H. MENZEL

(Illustrations by Martin Kallman)



Donald H. Menzel, Ph.D.

Dr. Menzel is the Acting Director of Harvard College Observatory. He was Assistant Astronomer, Lick Observatory; Director, Sacramento Peak Station of Harvard College Observatory; member Lick-Crocker Eclipse Expeditions, 1930, 1932; Director of Harvard-M.I.T. Eclipse Expedition 1936; three times winner of the A. Cressy Morrison Prize.

As I bowed my three visitors from my office, I congratulated myself upon the possession of such profitable clients. With life in our New England village so much a thing of the summer season, it was no easy task for even one lawyer to eke out an existence.

Of course, some elements of the situation were unusual. For one thing, that altercation before my very office. Surely there was distress in the pretty eyes of Miss Gregory as I opened the door; and then the elder Jamieson's curt admonition to me:

"Mark you, Finley, no more doles to this young scapegrace: I've had enough of his gambling debts. So now it's the races. Well, we'll let our young bantam dig for his money this time. No more advances! You hear, Finley?"

Even more strange was Jamieson's whole procedure—of having his will read to the heirs *before* his death. Still, Jamieson was an eccentric scientist, and I saw nothing particularly extraordinary in his latest caprice: that, in his lifetime, he should wish to set the seal of his approval upon what struck everyone as such an admirable arrangement.

Darley Jamieson had summered in the vicinity of our village ever since I can remember. For the past few years he spent a good share of the remaining time in his cottage up on the bluffs that looked over the seashore. From the exterior, at least, his home seemed to be a substantial colonial dwelling—large, but attractive. The interior, however, contained a large modern laboratory, equipped with every device that the most ardent experimenter could wish: optical equipment, electric and electronic devices in profusion, even a complete cryogenic equipment, which technical term (Jamieson explained to me) included devices for making liquid air, liquid hydrogen, even liquid helium. Jamieson was a specialist in the low-temperature field. His scientific contributions were of such a high quality that nominating lists for the Nobel prize frequently carried his name.

Jamieson worked hard at science—night and day. With his recluse habits, he might have passed entirely unnoticed were it not for his household. For a bachelor, he certainly managed generous family responsibilities.

First of all, there was Edmund. Edmund, Jamieson told us, was the son of a dearly-loved brother, who recently died in the Argentine; and if the affection that Jamieson lavished upon the boy could be taken as any indication, the brother must have been loved indeed. The young fellow was likable enough, but a bit erratic; and Jamieson's introductory proclamation that day at my office door seemed to betoken the final turning of the worm after a rather tortured relationship. Yet Edmund had a marked flair for scientific research. His uncle gave him every opportunity to work in the laboratory and Edmund

made rapid progress. Jamieson doubtless looked forward to the day when his scientific mantle would fall on younger shoulders. And to this end he drove Edmund with the same relentless energy that he used in his own work. Edmund's occasional erratic exploits were probably due in part to the tenseness of his work—and the desire of youth for release.

Then there was Joan Gregory. A more recent acquisition, she had been bequeathed to Jamieson's care by a dying college chum. Unmarried and childless himself, Jamieson found himself more than occupied with the managing of a rather problematical situation. Fortunately for him, his latest responsibility seemed also to provide the solution; for no one could doubt that, if anyone could manage Edmund Jamieson, Joan Gregory could. As a matter of fact, Edmund was head over heels in love with the girl from the very first. Soon she was reciprocally inclined, and, needless to say, Darley himself was delighted.

I dare say this situation determined the matter of Jamieson's will. Perhaps he wished to free himself from the responsibilities of a family and go back to his laboratory in peace. At any rate, the three of them were in my office that afternoon—Joan and Edmund came up from Boston on the noon train. Edmund appeared in no amiable frame of mind, no doubt because of his new financial straits at which his uncle hinted. Before the session in the office had ended, however, he regained his good humor. Joan was radiant.

Jamieson had requested me to draw up his will a few days before, and he summoned Joan and Edmund from Boston to hear its provisions. The terms of the will were simple. Jamieson directed that upon his death his entire estate should devolve upon his nephew, Edmund, and his ward, Joan Gregory, provided they should be married, or at whatsoever time they should be married. In the event that their proposed marriage should not take place within the ensuing five years, each was to receive one-quarter of the estate, the rest to be devoted to the establishment of an institution for scientific research as provided for in the will. Anyone present that day could have little doubt that the latter provision was simply a gratuitous alternative.

I bowed my clients from my door and listened to their footsteps receding down the staircase, with only the pleasant contemplation of the eventual, happy fortune hovering over the future heirs.

As I closed the door, the waning afternoon cast the gloom of premature twilight over the office. A glance from the window disclosed across the sky a cluster of dark clouds that betokened the approach of one of those sudden thunderstorms so common along the coast. Switching on the light, I settled myself at my desk to arrange hastily the papers connected with the Jamieson estate. It was growing late and I was eager to reach home before the breaking of the storm; nevertheless something urged me to set in order the details of the will before leaving.

Before I finished my task, the dark of the approaching storm blotted the last pale glow of the afternoon and the wind beat against the windows in a rising gale. Failing to find the umbrella that I usually kept at the office, I locked the door and ran down the stairs only to be met at the street by the first heavy drops of the storm.

Chagrined, I retraced my steps to the office. There was nothing now to do but wait for the storm to pass. Somewhat put out by the indefinite postponement of my supper, I picked up a book at random and, in no amiable mood, disposed myself to make the best of the situation. Outside, the wind rose to a scream and the rain fell in torrents. For some quarter of an hour the fury of the storm continued. Then suddenly, as if collecting all its might in one final climactic blast, there came a lurid flash and a deafening peal of thunder, after which the rain subsided to an intermittent, thinning drip.

Impelled more by exasperation than genuine interest, I contined to read, almost unaware of the storm's cessation. The book was a discussion of some fallacies of circumstantial evidence, particularly in their connection with certain well-known and spectacular cases of criminal insanity. Now I dare say, I am ultraconservative; however, I had always been of the conviction that a fantastic explanation of crime, in which the circumstances and the intent are obvious, constitutes nothing less than an affront to the intelligence of justice. I confess I was provoked to considerable controversial warmth by the bizarre accounts with which my author strove to confuse straightforward criminal procedure.

After I concluded the most preposterous account of all, I tossed the book in disgust upon my desk. At the same instant the street door below burst open with a crash, and I heard feet dashing madly up the staircase. A moment later came a thud as if something hurled against the office door, followed by frantic beating upon it. As I leaped from my chair, the door flung open.

"Edmund!" I gasped.

In the doorway, the rain dripping from his mud-bespattered clothing and his face pallid beneath the wet, matted hair, stood the younger Jamieson. His ashen lips twitched spasmodically; his eyes stared wildly; blank terror covered his countenance. I shall never forget his appearance. He looked as though he had seen a ghost.

"Thank God, Finley, you are still here!" he panted.

I took a step toward him, but he thrust me aside and sank trembling into the chair I had vacated. He passed a shaking hand over his brow and moistened his dry lips. Now and again a shudder shook his whole frame. Finally he fixed eyes of positive horror on me.

"God help me!" he moaned. Then suddenly, plucking me by the sleeve, he burst out: "Finley, I'm stark, raving crazy! Crazy, I tell you! Such things can't happen!"

I had never seen a man so completely unnerved.

"Finley," he continued, "he's gone—vanished like a puff of smoke! Blasted before my very eyes! The thunderbolt—withered like a dry leaf in fire—gone—I tell you, Finley, he's gone from the face of the earth! How could it happen? It's ghastly—a nightmare!"

Becoming incoherent, he finally burst into hysterical sobbing. My wits deserted me. I felt the manifest terror of the man insidiously imparting itself to me. I felt I was face to face with some awful cataclysm.

"Edmund," I finally managed to stammer, "for heaven's sake, pull yourself together. What is it?"

He seemed not to hear me. At last, however, he raised his eyes; but it was as though some haunting vision persisted in coming between them and me. He lifted a hand as if to brush it away. He seemed to be trying to master himself; and gradually I noted that he became more calm.

"Listen," he said. "I'll tell you. Don't pretend to believe me. I can't believe it myself."

He paused as if the vision again came before his eyes, but resolutely he pushed on.

"I'll tell you from the beginning. When we left you this afternoon, we first took Joan to the train. She was to return to Boston at once, you know. I stayed behind to go with Uncle Darley to the lab. He wanted to show me a new experiment.

"Already it was clouding up and we saw that we should have to hurry if we were to beat the storm; so we set off at once up the road leading over the cliffs. As we went along, Uncle opened his metal suitcase and showed me a peculiar gadget that it contained: a black, japanned box. I gathered that it had something to do with the experiment. I cannot be sure, though; for presently the storm broke.

"I've never been out in so heavy a storm. The rain came down in blinding sheets, and the wind beat against us so that we could scarcely stumble ahead. Only by bending nearly double could we make any headway. With the black clouds so low above us and the gusts of rain in my face and the steam from the earth, everything was as dark as a moonless night. The road became a bog. All communication was impossible. I could scarcely breathe as I struggled on with the wind shrieking in my ears and the surf lashing at the bottom of the cliffs.

"We had nearly reached the top of the cliffs, with Uncle Darley perhaps ten feet ahead of me, when I slipped and fell upon my hands and knees. At the same moment a flash of lightning blinded me and a terrific detonation shook the earth. The whole crest of the cliff was lit with a phosphorescent glare. I had a momentary impression of a chilly blast of arctic air. For an instant I was dazed. When my eyes cleared, the rain was stopping, but Uncle was no longer ahead of me. Thinking he had passed the shoulder of the cliff, I ran after him. Then the frightful realization broke upon me. *He was gone!*

"I looked around. Not a trace of him remained. One minute he was directly ahead; an instant later he had vanished as completely as if the earth had swallowed him—or—" here Edmund paused with a peculiar light in his eyes "—or as if a single bolt of lightning had shriveled him!"

Edmund paused in his amazing recital and looked at me helplessly. My consternation must have caused me to stare at him stupidly, for a moment later he went on with some asperity:

"Well, that's all there is to tell. I ran all the way back, hoping to find you, Finley, for heaven's sake, help me! What could have happened to him?"

There was something pathetic in the almost child-like helplessness of his appeal. As for me, I could only be astounded by his incredible story. Surely Darley Jamieson could not have vanished into thin air.

"Are you certain," I questioned, "that he couldn't have been concealed by some crevice in the rocks. Perhaps he was struck by the bolt of lightning and hurled aside; lightning acts in strange ways."

Edmund shook his head.

"No," he replied positively; "he was gone. There aren't any rocks—only the sand. I looked, and he wasn't there."

"The cliff," I proposed. "Blinded by the flash, he may have fallen into the sea."

Edmund shuddered, no doubt at the thought of the angry storm-tossed surf. Then he gave me a queer, hunted look and said in a dry voice:

"No; I thought of that. He didn't go over the cliff. He has vanished."

There was something odd about Edmund's manner. It seemed as though there were something in the experience that he could not impart to me.

"Come," I said abruptly, "we must get help and search the cliff. Even now your uncle may be dying in some crevice you overlooked."

Without waiting for his reply, I seized the telephone and rang up the police station. Marshall, the chief, I knew fairly well; and, although only three men were on the night shift, I felt pretty confident that at this hour he would have at least one of them with him. I was right. Marshall was a good deal amazed at the hasty summary of the situation I gave him, and promised to be with us immediately.

I had barely finished locking the office when Marshall joined us at the foot of the stairs. He must have run all the way. Briefly I outlined Edmund's story, and then the three of us set off toward the cliffs.

By the time we reached the road that wound over the brow of the cliff, the heavy clouds had lifted, but the twilight was lengthening into dark. Fortunately Marshall had brought a lantern, and this we now lighted. Almost at a run we struggled up the rocky road, splashing through the puddles and slipping in the gummy mud that clung leadenly about our feet.

We were panting hard as we neared the top of the cliff. Suddenly Edmund held out a hand to stop us.

"It was here," he said in a strained voice, "that I slipped as the flash came. When last I saw him, Uncle was there, just on the crest of the cliff, outlined against the sky." He indicated the spot.

I was about to walk on when Marshall restrained me. He seemed deep in thought, with his eyes fastened upon the road. Suddenly he stopped and held the lantern so that its rays fell upon the miry path. He concluded his examination deliberately, then glanced at Edmund's shoes and straightened with a grunt of satisfaction.

"Fortunately," he announced, "the mud has preserved the footprints. These"—he pointed toward several broad impressions—"are undoubtedly yours, are they not, Mr. Jamieson?"

Edmund confirmed the observation.

"Here they abruptly ended."

"Then," continued Marshall, "these others must have been made by your uncle."

I bent to examine the footprints. Sure enough, the abrupt cessation of the rain, together with the sandy soil at the top of the cliff, had recorded the impressions as distinctly as if molded in clay.

"Now," directed Marshall, taking charge of the party, "let's have a look at the top of the cliff, but be careful not to walk in the footprints."

At the top of the cliff, I looked about me eagerly. Here a path opened into a little plateau that broadened gradually until it accommodated the few scattered cottages at its farther end. Yet, strain my eyes as I might in the darkness, I discovered no vestige of Darley Jamieson. More than that, I found Edmund's statement to be true. There was not a single rock or crevice which could have concealed a body. The shelf of the cliff was as flat and bare as the palm of my hand: everywhere only the smooth sand stretched away into the darkness.

A sudden exclamation called my attention to Marshall. On hands and knees, he was crouched in the roadway, his eyes intent upon the muddy earth. A step brought me beside him. Here, for several yards, was an interweaving of footprints; yet in the midst of them the unmistakable tracks of Darley Jamieson stood out distinctly. Unswervingly they reached to the crest of the cliff where two, more deeply indented than the others, seemed to indicate that he had stopped. *Here they abruptly ended; beyond there was no trace.*

For a moment we stared at each other in silence. There was obvious perplexity in Marshall's eyes. He shot a glance skyward.

"It looks as though he had been caught up by a balloon," he declared. "One thing is certain: he never took a step farther than this."

Presently his eyes fell upon a single line of footprints leading toward the edge of the cliff. He examined them in silence and then turned to Edmund.

"I went to see if he had fallen over," explained the latter.

Marshall gave him a searching look.

"Hardly," he replied gruffly. "It's ten yards from here to the edge."

Further search was futile. We even went as far as Jamieson's laboratory, but to no avail. Beyond the ominous finality of the two deep-set footprints that marked the point where his trail abruptly ceased, not a single trace remained of the man. Perplexed and disheartened, we turned back toward the village.

NEXT morning found me at the office a good deal earlier than usual. I had had precious little sleep during the night, and dawn overtook me too disturbed in mind to lie longer abed. Upon leaving Edmund at his hotel the night before, I had directed him to see me first thing in the morning. So I set out for the office to fret away the time there until he should appear.

What I needed most of all was strength, and leisure to think seriously. Yet the strain of the night left me scarcely fitted for the necessary close concentration. I fear I did little but nervously pace the office and reiterate the unanswerable questions, over which I had tossed all night. The case was incredible. Try as I might, it remained as insoluble as at the moment Edmund had first poured out his account of it. The very absence of anything extraordinary in the general circumstances rendered only more staggering that particular impossibility—the disappearance of the scientist. That, and that alone, fell beyond the realm of possible happenings of any commonplace day. Yet that had happened!

The great clock on the town hall boomed the hour. Eight o'clock! What could be keeping Edmund? Surely he could not be sleeping while the shadow of his uncle's murder hung over the village. Murder! The thought came to my weary brain unbidden. True, throughout the night it stalked like a disquieting apparition through the confusion of my half-conscious speculations, but only the readiness of its recurrence in the cold light of morning apprised me of the strength of its crystallization in my unconscious interpretation. I tried to banish the thought from my mind. Surely there must be some other, some perfectly natural, explanation. Impatiently I glanced at my watch. But what delayed Edmund?

At that moment came a knock on the door. With a sigh of relief I threw it open; but instead of Edmund I confronted Marshall. There were deep lines of perplexity upon his face. Apparently he read the disappointment in my eyes, for his first words came as an echo to my unspoken thoughts.

"Finley, have you seen Edmund Jamieson this morning?"

I replied in the negative; and Marshall accepted my invitation to enter. For several minutes he stood gazing about the office abstractedly; then abruptly he exclaimed:

"Finley, this has me beat! It's so confounded clear that an idiot could see it—but, for the life of me, I can't believe it."

Idiot or not idiot, I could only confess that nothing was particularly clear to me.

"The disappearance, you mean?" I asked.

Marshall looked at me queerly.

"Yes—the disappearance."

I felt uncomfortable.

"You say you haven't seen young Jamieson this morning," asked Marshall again.

I shook my head. Marshall continued his stupid staring about the room; then, with another abrupt shift of thought, he said:

"I've had another look around the cliffs this morning."

In answer to my look of interrogation, "No, there's nothing new. I've got Hobson and Whitney up there now on guard. We had to rope off the place. Somehow, people got wind of the affair, and the whole town turned out before breakfast."

He paused for a moment's thought.

"I went up to the cottages, too. No one's been over to the Jamieson place since yesterday—the other cottagers vouched for that. Nobody in town's seen Jamieson either: I asked at the garage and the depot. One thing's sure: Darley Jamieson never came down from that cliff—by the road."

There was a significant intonation to the last words.

"What do you mean?" I demanded.

Again Marshall gave me his queer look.

"We're having the beach searched all along the coast," he replied.

"Then you think he may have fallen over the cliff after all?"

Marshall's voice was cold.

"He may have been *helped* over the cliff."

At last, unwillingly, I was forced to recognize the drift his comments were taking.

"Do you mean," I expostulated, "that you believe Edmund Jamieson guilty of such a thing?"

"There's one set of footprints to the edge of the

cliff," he persisted doggedly and with some heat.

"Nonsense! He explained that."

"I told you it had me beat. I can hardly believe it either." Suddenly he drew up a chair and straddled it. "Look here, Finley," he said, "we might as well face things squarely. I can't fit this in with what I know of young Jamieson, any more than you can. But facts are facts, and there's enough evidence to make things damned uncomfortable for Edmund Jamieson before the jury. Circumstantial, I'll admit, but powerful. Look here. Old Jamieson and Edmund went up on the cliff; Jamieson went no farther; Edmund came back alone; only one trail of prints to the cliff edge to tell what happened; and Edmund so rattled he can't think of any explanation but that cock-and-bull story he gave us. Finley, this isn't the Middle Ages—people don't disappear by magic. Lightning has killed many people but it doesn't evaporate the body or toss it more than thirty feet.

"There's only one link missing, and that's a motive—though there is rumor that Edmund and his uncle were not always on pleasant terms. As to that, no doubt you can supply some information when the time comes. And there are times when a man acts criminally on impulse."

Marshall waited for my reply, but none could force itself to my lips. Only too well I began to visualize the chain that was forging for Edmund Jamieson. Marshall spoke plainly; and I suddenly realized how terrible my own position would be. Only one link missing, Marshall had said—the motive. And, if I were to speak, all I could say would only make that motive plain.

Perhaps Marshall sympathized with my troubled silence; perhaps he even understood it. There was a good deal of discernment beneath the commonplace exterior of the Yankee chief constable. At any rate, he arose, in his abrupt way, to go.

"They'll no doubt be sending a man down from Boston," he said. "This is too big a job for us to handle alone. I just thought I'd drop in and let you know how things stand. You're more interested in young Jamieson than anyone else, I guess; and it'll be a few days before we take any action."

The hint was unmistakable. I was sure now of the understanding—and the sympathy. I could only grip Marshall's hand, and he was out of the office.

He met Edmund ascending the stairs, but only a curt nod passed between them. Then Edmund was in my office and, before I had time to collect my wits from the one interview, I found myself faced with an even more perplexing problem.

Edmund was distinctly ill at ease. A glance at his lined face told me that sleep was not the cause of his belated arrival. Affectionately, for I really liked the boy, I placed my hands upon his shoulders and tried to strengthen him with a few words of encouragement. He avoided my eyes. Uneasily, in spite of my liking for him, I felt Marshall's suspicions obtruding upon my thoughts.

"Have they found anything?" he asked presently, in a dull voice.

"No." I replied. "But, Edmund, you are late."

He looked at me wearily.

"I had to wait to send a telegram. The office doesn't open until eight."

The subsequent conversation brought us no further than we had gone the night before. With fruitless reiteration Edmund detailed again the events which led up to the disappearance of Darley Jamieson. Fantastic as it was, upon that point Edmund doggedly insisted with convincing single-mindedness. As for the rest, Edmund's demeanor left me more disquieted than I wished to admit. He was patently ill at ease, manifesting from time to time a suppressed indifference, even, I felt, a positive resentment toward our discussion. And once or twice he seemed about to speak of something but always changed his mind. I grew confident that more was involved in the case than Edmund Jamieson was willing to disclose.

After an inconclusive half-hour, Edmund departed. I fancied that I detected an air of relief as he took my hand and left instructions for calling him at the hotel, should anything turn up. And then I was alone—alone with the knottiest tangle of perplexities I had ever imagined, and perturbed by suspicions I tried vainly to evade. Unconsciously I picked up the volume I had been perusing the night before, and all the unassailable refutations my cold logic had turned upon it rolled back upon me with ironic significance. I am ordinarily the most even-tempered of individuals, but in my exasperation I hurled the book into a corner. How dared I face the conclusion that calm reason indicated so unmistakably?

THE next two days dragged interminably, with the investigation apparently no further advanced than at the beginning. On the morning of the second day, however, according to Marshall's prophecy, a special detective arrived from Boston. I saw Edmund infrequently; indeed, he seemed distinctly to avoid me. As for Marshall, upon the few occasions we chanced to meet, his uncomfortable manner and reluctance to speak emphasized the direction official suspicion was taking.

On Sunday afternoon, Marshall telephoned me. "Thought you ought to know," he said. "But the circumstantial evidence seems to be piling up. We've recovered that suitcase."

"What suitcase?" said I, trying to fit his words into my knowledge.

"The metal suitcase that Darley Jamieson took into your office and carried away with him to his death," Marshall replied. "The initial 'D.J.' is unmistakable on the metal. We found it this morning, worked up on the beach below the cliff. We feel that this is definite evidence that Darley Jamieson also went over the cliff."

My heart sank. The weight of circumstantial evidence was increasing, Marshall went on. "One peculiar thing, though. *That metal case was surrounded by a layer of ice.* We had to chip it away to open the container. And then we found only a meaningless tangle of wires, and electronic tubes all in a box of japanned metal. We're holding it for evidence, of course. But no one could have hurled it from the road to the cliff. Too heavy. Someone dropped it there!"

Darley Jamieson's disappearance had occurred upon a Thursday. On the Monday following I precipitated a stormy scene with Edmund. Up to that time a peculiar insensibility had apparently left the latter oblivious to the precarious position he occupied; but on this particular day, baffled wits and frayed nerves drove me to a none-too-optimistic enlightenment. At first, I believe, the idea stunned him; then he broke into vehement denial with a heat that left scarcely one of us unscathed by accusations of imbecility.

"Finley," he blazed. "I don't care what you think or what anybody else thinks about this mysterious affair. I know—or think I know what happened. And you've got to help me!"

Edmund gesticulated wildly. "I must have that

"A gray light seemed to dawn about me."

suitcase and what it contains! I'm sure that it holds the answer to the mysterious disappearance!" Thereupon he bounced out of my office.

I called Marshall, asking for release of the case. First threatening numerous writs and later guaranteeing safeguarding of the case and contents, I received it and turned it over to Edmund, for whatever might develop.

It was a beaten, weary, and dejected Finley whom Marshall found on the Thursday after Jamieson's vanishing. I had not seen him for several days—by design on his part, I had come to feel; therefore I was somewhat surprised when he dropped in about mid-afternoon. After a perfunctory greeting, for some time he stood fiddling with his enormous watch-chain in palpable embarrassment before he brought himself to speak further. Finally he said:

"Finley, I hate like blazes to tell you, but if you're going to do anything for young Jamieson, you've got to hurry. Things look mighty bad for him."

My response was feeble enough; whereupon Marshall continued as if eager to conclude the matter.

"When I mentioned motive the other day, I can understand your keeping quiet about some things, Finley; you needn't bother any more. We know about the will." In answer to my look of surprise, he went on: "Miss Gregory gave it away before she saw what it meant. Did you know, too, Finley, the lad's head over heels in debt?—gambling, we've found."

What could I say? All along I had known the damning facts would sooner or later come to light. Without waiting, however, for an answer, Marshall played his trump card.

"What do you say to this?" he said, laying on the desk before me a duplicate telegraph blank. It was signed by Edmund; and from the date I recognized at once that it must be the telegram which had delayed Edmund the morning after his uncle's disappearance. I recognized only too well the significance in its brief wording. It read:

"SAY NOTHING NOW. PAYMENT DEPENDS UPON YOUR SILENCE. WILL HAVE FUNDS IN FEW WEEKS."

I shrugged my shoulders.

"Well?"

"I needn't explain it." Marshall folded the paper and restored it to his pocket. "Maybe I shouldn't say anything, but tomorrow there'll be a warrant for Edmund Jamieson's arrest!"

For a moment the chief paused, mingled emotions struggling in his face. Then he laid a hand upon my shoulder.

"Finley," he said, "I know you think or at least hope that the boy's innocent. For God's sake, if you know anything to do for him, do it quick!"

Do something? But what? Heaven knows I tried to answer that question after Marshall had gone. Yet in the face of this all-but-conclusive evidence, what had I to offer? Only an incredible story that even I could not believe.

A ring of the telephone interrupted me. It was Joan Gregory. She was calling from the hotel and her voice was urgent. Since I felt that she could contribute nothing to the perplexing situation, I had advised her to remain in Boston. But, without notifying me, I discovered, she had arrived the night before.

"Mr. Finley," she was saying now, "I must see you at once. Oh, I need advice terribly!"

Alarmed by her tone, I replied that I should remain in the office until she called, and ten minutes later she was with me. Her distress was pathetic. As she accepted a chair, her hands clasped convulsively, and I could see that she was close to tears.

"Oh, Mr. Finley," she burst out, "this is awful! Poor, dear Uncle—I can't believe he is—dead. And now they say Edmund has done it. It's horrible!"

Here the tears sprang into her eyes. I did my best to console her—awkwardly enough, I admit. I've never been particularly adept in dealing with ladies, and ladies in distress devastate me. Fortunately she recovered herself in a moment. Drying her eyes, she continued more calmly.

"Mr. Finley, we were to have been married in a few months. Now everything is upset. I don't know what to do. To continue with our plans would only make Edmund seem more guilty; to break our engagement now would appear as though I, too, thought him guilty. Oh, what shall I do?"

I confess that I didn't know. My brain was past thinking intelligently. Mercifully it was unnecessary for me to decide, as I discovered in her next words.

"I had to see Edmund last night," she went on. "He has changed so. I hardly recognized him. His eyes are wild and his hair ratty and uncombed. At first I thought he was drinking—but then I realized that it was mostly lack of sleep. And he doesn't eat either.

"Oh, Mr. Finley, he is spending night and day down in that low-temperature laboratory. He didn't want to see me and made it clear that all he wanted to do was get back to his experiments.

"We compromised and I went down with him, to talk while he was working. I might just as well have

been one of those machines for all the attention he paid to me. He never stopped once. Connecting wires and reading dials and gauges. The room was a mess.

"But I had to tell him—I broke the engagement."

"You what?" I demanded. "But why?—why?"

Her reasoning was clearer than mine.

"It was the only thing I could do," she said. "To go on would only prove the reason . . . besides—oh, I don't know . . ."

An incredible light broke upon me.

"Besides," I repeated, "*you fear that he is guilty!*"

She bit her lip, eyes fallen. Then, hopelessly, she nodded. The admission put an end to the conversation. What more could I say? More courageous than I, Joan Gregory had dared to own to the conviction that I no longer could deny. Poor Edmund!

We sat silent in the dingy office as the late afternoon waned. Then disconsolately she went away, and I returned to my chair and to my endless brooding. The end had come—I knew it. The very fact that I could say nothing of hope or comfort to Joan Gregory proved it to me conclusively. Until the afternoon I did not dare to admit the truth; at last there was no other way. Tomorrow the warrant would be served; Edmund would be led away, while I sat here, helpless, beaten. It was the beginning of the end. Yet what else remained? Fight it as I might, I knew I had to acknowledge it: Edmund Jamieson was guilty—guilty, if ever a man was. Not a straw remained to be grasped —nothing but a wild tale of fantastic impossibility.

The last streak of day faded from my square office-window. I lighted the dusty lamp and returned to my chair. Outside the twilight deepened. The darkening sky carried the threat of storm, as thunder reverberated from shore to cliff.

Unexpectedly, a knock sounded on the door. In response to my weary invitation, the door swung slowly open.

Wild-eyed, wide-eyed Edmund entered, followed by his distraught fiancée.

"Come, Finley," he demanded. "I need help, in order to prove my case."

"You're mad!" I exclaimed. "What do you want me to do?"

Joan laid a hand on my shoulder. "Do come," she urged. "I don't know what he wants, but I feel that tonight it is now or never. Please help if you can!"

I could not resist her appeal. Again without protection from the storm, I left the office and followed the two—Edmund and Joan—toward the cliff road. Edmund was carrying the mysterious metal suitcase, with the letters D.J. on the outside.

A drizzle soon turned into a downpour, lashed by sharp gusts of wind. We were shortly drenched, although the drama sustained us in spite of physical discomfort. At the top of the cliff, Edmund paused, opened the case, and drew from it a remarkably complex piece of electronic equipment. He carried it to the precise point, still marked by a stake, where Darley Jamieson's last footprints had been engraved in the sandy clay of the cliff road. He connected the device to some heavy wires lying on the ground.

"I must be right," Edmund said to me. "And yet I have never been less certain. I've read Uncle Darley's notes. . . . But the idea is preposterous."

"What do you mean?" I asked. "All this mystery." Edmund held up a finger to silence us.

"These wires," Edmund announced, "are connected to a lightning rod on the top of the hill."

We waited, all three of us, in the darkness. The night wind whistled over the cliff and the rain lashed us unmercifully. An occasional flash of lightning revealed our faces—white, drawn, tense—waiting for we knew not what.

And then, without warning, the great flash. A bolt of lightning that burned along the wires, a dazzling flash that seared our eyeballs, a thunderclap that sounded like the end of the world.

And as the greenish glare faded, as the last rolling peal of thunder reverberated from cliff to cliff, we saw an apparition. I was on my feet, breathless, my eyes staring into the darkness. My flashlight cut through the gloom. There, ten feet ahead, clearly revealed by the light, stood Darley Jamieson!

It was several days after his amazing reappearance that Darley Jamieson assembled us in the living-room of his cottage on the cliffs. He was particular to include Marshall and myself in his invitation. Edmund, of course completely cleared of all shadows of suspicion by the return of his uncle, once more was happy in the prospect of his forthcoming marriage; and Joan, by his side, emerged like an unfolding rose from the cloud that had hung over them. Her radiance was sufficient to rejoice the heart of any man.

Darley Jamieson himself had been strangely reticent about his recent experience. To the pressing of all inquiries he vouchsafed no response except that the explanation was too involved for summary dismissal, and that all would be cleared up when the proper time came. The little he revealed increased our perplexity. For he was steadfast in his support of Edmund's fantastic assertion. Vanished he actually had, so he said, at the very point where his footprints stopped. To us the whole thing was preposterous.

Well, here we were, the five of us. We hoped that it was at last the "proper time," and we were not disappointed. There was much, too, to excite our curiosity. A great change had come over Darley Jamieson; he was like a man set apart. During the intervening days he had seemed to dwell under a great perplexity; and now there was a troubled look in his eyes, as though he beheld something he scarcely dared to mention.

After setting out drinks and cigars and seeing to our comfort, he settled wearily into a chair, and then abruptly broke our expectant silence.

"I regret that unwittingly I have been the cause of so much distress," he began. "I owe you an apology; and assure you that, had not events of which I never dreamed come to pass, I should never have ventured submitting you to such grave anxiety. Under the circumstances, the least recompense I can make is to explain what is to you so incomprehensible—and justly so—my disappearance."

He paused, while we leaned forward, intent upon his words.

"Yet I almost fear to do so," he resumed after a moment of knitted brows. "I can scarcely comprehend it all myself. In the beginning, when first I found myself returned, it was all as obscure to me as now it is to you. Since then, however, I have tried to piece together the twisted threads until at times it seemed that they formed a pattern. At last, the whole meaning broke upon me. I scarcely dare believe, and yet I know. The secret is stupendous—inconceivable! *Is it possible that one can know what I know—and still live?*"

His voice died away into an awed hush. He appeared to forget our presence, while his misted, troubled eyes seemed to penetrate beyond the confines of the room and rest upon a mystery that only

he could see. Again he straightened abruptly as if to shake off some invisible influence. and, as the mood of musing thus dropped from him, he spoke once more in a calm, studied voice.

"First of all, you must know that I have devoted most of my life to the pursuits of science. Recently my interests were focused upon one absorbing problem. The results you witnessed—suffered from.

"In order to understand what I wish to reveal, you must listen briefly to my theories." He hesitated for our nod of acquiescence, then proceeded as though delivering a carefully prepared lecture. "In the first place, you must realize the tremendous part that temperature plays in our existence. One need only reflect upon the rise and decay of life cycles, and the progress or backwardness of civilization to comprehend the paramount importance of this consideration. After all, temperature is the primary determining factor in national development.

"As yet, however, our knowledge of temperature is only in its infancy. Amazing as it may seem, scientists have been satisfied to deal with but half its possibilities. For, unlike time or space, which are infinite in both directions, temperature is commonly considered infinite in but one. It is recognized that no limit can be set to the maximum rise of temperature; *on the other hand, we illogically postulate a level below which temperature cannot fall—that is, what is known as absolute zero!*[1]

"How arbitrary this is! On every side science testifies to the infinity of all things. It is like the horizon, ever receding before one—there is no beginning and no end. How absurd, then, is the concept of absolute zero! It is in fact a midpoint between infinity and infinity. With the scale on one side of that point we are familiar; to the other we have obstinately shut our eyes."

Darley Jamieson paused for the significance of his words to become clear. We listened breathlessly.

"This is the problem," he continued, "to which I have devoted many years of my life. Let me explain the theory upon which I worked.

"It is a comparatively simple matter, theoretically, to reduce temperature to absolute zero. True, the gradual process requires infinite time and skill; nevertheless, it is possible. I have, in turn, made liquid air, solid air, liquid helium, solid helium. But to push beyond zero—ah, that was my dream! And why not? Before this, we have attempted to approach absolute zero step by step.[2] By this method it could only present an insurmountable obstacle. But with enough force, with enough impetus, the strongest barrier can be penetrated. *How then, if temperature could be reduced so rapidly that the impetus of its downward drop would carry it beyond absolute zero?*

"Let me use an analogy. Suppose we were to lower gradually by a string an inflated rubber ball into a tank of water: as it reached the surface, it would stop and rest upon it, nor would we expect it to sink beneath that surface. But suppose we were to stand directly over the tank and hurl the ball into the water with all our force: in that case it would *not* stop at the surface but, driven by its impetus, it would penetrate beneath. Why should temperature not behave in the same way?

"But, you may object, what is the value of such

[1] Absolute zero—the point at which theoretically all molecular motion ceases. It is 459.6 degrees below the Fahrenheit, and 273.15 degrees below the Centigrade zero points.—*Editor.*

[2] The lowest temperature reached, so far, by scientists is about + 0.001° K., i.e., 1/1000 degree above absolute zero.—*Author.*

"Keep off!" he shouted. "Don't touch me!"

effort, to penetrate beyond absolute zero? Indeed, how may we even know when we have passed below this point? For, if zero stands for nothing, how can we conceive of something less than nothing? Yet actually such objection presents no difficulty. Rightly considered, even negative values possess reality. For certainly, since rise in temperature is merely a matter of the application of greater quantities of heat, it requires a greater amount of heat to raise a substance from ten degrees below zero to a given temperature, than it will from zero itself. Yet in the face of this momentous indication, we have been satisfied to base our theories of heat and energy, and even of life itself, upon only the positive scale of temperature—that is, above absolute zero. What of the vast unexplored realm lying upon the other side of zero wherein heat and energy—or even life—can be conceived of only as negative?

"Temperature on the other side of absolute zero would correspond to negative energy. The full explanation is complicated, but the basic principle is simple.

"I found that the equations of thermodynamics, generalized to include the effects of the Einstein theory of relativity, are *quadratic*, not linear. These equations give two roots—one positive and one negative, as alternative values for the temperature. This theory gave me the clue; the rest was experimental proof that the two worlds of opposing temperatures coexist without actually overlapping.

"But, after all, what's so surprising about this? Dirac, for example, developed the entire theory of a negative universe that coexists, invisibly, with the positive universe. His theories dealt primarily with electrons—and led to the prediction and eventual discovery by Anderson of the positron, the positive electron. So, with all this theory to guide me I tried to penetrate the mysterious zero barrier.

"Recently I have been successful. At first I could project insects to the realm of sub-zero temperatures. I proceeded, then, to project mice and rats. I had no idea that I myself would be the subject of the next experiment!"

Darley Jamieson was speaking rapidly with a sort of nervous enthusiasm. Now, as he paused, my brain whirled in a chaotic dance of half-comprehension. In spite of the bizarre hypothesis, I felt my objections melt away before his calm conviction. The effect was staggering. My whole universe of solid realities was turned topsy-turvy and made to mean something entirely different. Our faces must have expressed strong doubt and perplexity, for Jamieson turned from one to the other to survey us keenly.

"You are skeptical?" he queried with an odd, resigned tolerance. "Ah, you think it all fantastic! Well, I, too, pondered long, and it seemed only a dream. Now I know!"

With this cryptic remark, he arose to his feet and crossed the room to an old-fashioned desk that filled the corner. From one of its voluminous drawers he extracted a small, flat object. With this in his hand, he returned to his chair. Carefully he laid the object upon the broad arm of the chair and for a time regarded it solemnly. It was the small oblong box, of japanned metal, I recognized it from Edmund's description, as the contents of the metal suitcase. Externally, there was nothing remarkable about the box; but the grave air with which Jamieson mused upon it and the unusual circumstances of its introduction served to lend it an ominous fascination. Before we could ask any questions, however, Jamieson returned to his carefully worded explanation.

"You must know," he went on, "that material existence, fundamentally, is connected with heat, or energy. Now heat itself is not a material substance to be added or taken away in order to alter temperature; rather it is motion, the motion of material particles—in their smallest form, atoms. Yet, in spite of the common recognition of this fact, its enormous significance has been neglected, because of a strange obtuseness that at times blinds science. All prior attempts to reach absolute zero have utilized the well-nigh hopeless method of draining off heat little by little. Yet what is more logical than to strike at the root of the matter—to eliminate heat by eliminating motion?"

Here Jamieson picked up the japanned box from his side and, leaning forward earnestly in his chair, held it out for our inspection.

"This," he declared, "is the fruit of my years of experimentation. With this I shall succeed—rather, have succeeded—where so many others have failed. I have said that heat is simply motion, and that heat would vanish were the motion of the atoms to be stopped. But, if the atoms were to be stopped suddenly, the reduction in temperature would be so precipitous that the resultant impetus *might* carry the temperature *below* absolute zero. The little machine I hold in my hand has the power to *render the atoms motionless instantaneously!*"

We stared at the little black box with an awe that might have attended a calm announcement that it contained nitroglycerin due to be touched off in a moment! I believe we scarcely breathed. Spasmodically, Marshall reached for another cigar and lighted it with one hand, unconscious of the half-smoked remnant that had gone dead in the fingers of the other. Jamieson replaced the box on the chair-arm with a wave of his hand.

"You can guess the rest," he said. "I was carrying it in the metal case to protect it from the rain, on the day of my disappearance. The device, of course, is electrical. In the strong electrical field set up by the bolt of lightning that stunned Edmund, the mechanism went into operation, its current far more powerful than I ever anticipated. The atoms of my body were paralyzed. *In the fraction of a second I had ceased to exist!*

"What!" gasped Marshall involuntarily.

"You don't believe me?" returned Jamieson with an unexpected flash of irritation. "Well, then, listen—I'll tell you what happened. Of course, I vanished: it is only the activity of the atoms that keeps us visible. And don't forget that time itself, as we think of it, is always associated with matter and motion, whether it is the swing of a pendulum or the rotation of the earth. Therefore, as motion ceased for the atoms of my body, so time ceased to exist for me.

"What happened? I can tell you only what lingers with me—vague, nebulous, scarcely comprehensible. First, the flash of lightning; then, agonizing chill in my heart. I felt my sinews grow rigid. It was as though my whole body were turned to stone. Then sickening numbness fell upon me. A reeling vertigo ran through me. I felt myself losing my balance, inevitably sinking backward, and yet caught, as it seemed, eternally in that moment of palpitating suspension when one feels oneself falling, yet powerless to avert the abyss at one's feet. And all the while, as though searing my eyeballs, one last, intolerable flash of light. Then, at last, blackness."

Jamieson's voice trailed away into silence. His brows contracted over eyes that were hazy, yet which seemed desperately striving to visualize whatever eluded them. He was completely oblivious of us, and when he spoke again, his voice seemed to filter to us from the veils of a dream.

"I cannot tell how long I remained unconscious. I cannot even tell whether I was ever conscious of *time*. I do not recall that it occurred to me. It seemed that time did not exist. I only know that sometime, somewhere, I knew I existed. A gray light seemed to dawn about me. It was as though I floated in the midst of clouds. I felt that I was not alone, that others hovered about me—things perhaps; perhaps persons. I don't know. I did not see them; there was no sight. I recall that I thought I heard voices, but I could not hear: there was no hearing. I had no body: there was nothing I could recognize as myself. Only I *knew*—I simply existed. *I was an essence, a being.*

"But don't think that I was unconscious. Oh no, it was far different; it was quite the reverse. I was ecstatically conscious. All about me indescribable, inconceivable wonders poured in upon me. There was no sight, no sense, no experience; I did not acquire, I did not impart; I was merely conscious. Nor was there any limit—no beginning and no end. All things were present in me, and I in all things; only there were no things—only being, existence, consciousness . . ."

Jamieson's words had constantly become more troubled, more tortured. Suddenly he ceased speaking altogether and pressed his nervous hands hard upon his cheeks. Then with a gesture of despair he seemed to thrust away the enfolding veils from his eyes. There was something unutterably pathetic in the helplessness of his next words.

"Oh, how can I try to make it clear to you!" he burst out. Then with a sort of dull resignation, he continued. "It's not a question of memory; it is the meagerness of words, tied as they are to our earthly knowledge, to suggest the ineffable. One might as well try to describe red to a blind man."

"But *where* were you?"

The question was Marshall's. Doggedly he was attempting to follow the explanation which obviously was fast leaving him mired in confusion. His blunt question, however, was one which must have been in the minds of all of us. Jamieson shook his head slowly.

"Ah, that is what has tortured me. If only I could find the key. One can only speculate. But listen—perhaps I touched the Truth."

He stroked his graying hair thoughtfully.

"All mortal knowledge descends at last to the tangible. Life exists only as it is circumscribed by the material. We, the Earth, the universe, came into being only by the readjustment of matter. Yet our aspirations are not shackled by the material: all we know lies within the circle of our physical existence, yet we dare dream of what may be when we lay aside our physical self. We postulate an immortality and theorize about it, always looking ahead, as is the destiny of man. But what has gone before? The individual takes up his Earthly incarnation by a material readjustment as old as time; yet he is an individual, new, unique—a personality drawn—whence?"

Were Jamieson not so calm, so contained, so deadly in earnest, I should have believed his senses unbalanced. As it was, I began numbly to perceive the drift of his explanation. Now, with a new glint in his eye, his manner quickened.

"What," he demanded, "what if one should cease speculating about the future—about existence after death—and should reverse the process of creation; should divest oneself of one's material sheath, and push back, back before life, as we know it, was? If one should be able to recapture disembodied essence —*pre-being!* What then?"

His eyes flashed. Then solemnly he tapped the chair-arm with a trembling finger.

"My friends," he declared, "as God is the judge of my honest belief, that's *where* I was! That is where I should still be had not Edmund grasped the essence of the problem and connected the machine *in reverse*, so that a flash of lightning could reinstate the normal temperature of my body. I have come back—back from that other realm, where mystery lies—*from the other side of zero!*"

An awed hush followed the astounding words while Jamieson turned from one to the other a piercing scrutiny. Then, unexpectedly, his calm restraint dropped from him. Abruptly, yet without a word, he leaped to his feet and, seizing the japanned box, crossed the room with swinging strides to a corner table upon which rested the coiled wires of electrical apparatus. Here he swung about, a sudden flush of angry determination in his face.

"You don't believe me!" he shot back at us. "Oh, I know what you are thinking—an old man, touched in the head with his crazy theories! But you'll live to believe me! I'll make you believe!"

Meanwhile his fingers were trembling agitatedly among the coils of wire. He clipped leads to the box and lifted the oblong box to his chest. Two spots of anger flamed upon his otherwise pallid cheeks. As he spoke again, his voice was high and grating.

"I'll prove I'm right! Stand back—I'll repeat the experiment!"

We blanched in horror. Joan Gregory screamed.

"Uncle Darley!" cried Edmund in protest, and lunged forward to interfere. Jamieson waved him back.

"Keep off!" he shouted. "Don't touch me! I know what I'm doing!"

His hand upon the switch closed the electrical circuit. The awful power was unleashed. Edmund threw an arm before his eyes. I heard Joan Gregory sobbing. Then I was conscious only of pulsating silence, punctuated by the piercing tick of a clock and by my own sharply drawn breath.

For a moment we stared, speechless, paralyzed, like a tableau in stone.

In the dazzling flare of dancing electric sparks, the face of Darley Jamieson grew dim—transparent. Moments later, as the light faded, we realized that only four persons remained in the room. Jamieson had vanished completely.

THUS far, all our efforts to bring him back from the other side of zero have failed completely. Thank God for Marshall! I firmly believe that only his staunch, unimaginative testimony saved all of us from the otherwise unavoidable conclusions of circumstantial evidence.

Darley Jamieson must still be in that laboratory room, or in an invisible room that coexists with the familiar universe. He *must have* known where he was going and what effect it would have on him as well as upon us.

As for Edmund, he and his wife Joan work ceaselessly in the laboratory—puzzling out the secrets of that mysterious world on the other side of zero.

cosmatomic flyer

COVER STORY

. . . *Powerful searchlights, checking his flight* . . .

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NEW YORK News Times

SF

BY GRENO GASHBUCK

(*Illustration by Charles Hornstein*)

NEW YORK, Dec. 27, 1968—The recently perfected cosmic-atomic reaction engine, invented by the famed Professor Pierre Lementeur of the Sorbonne of Paris was tried out yesterday on the grounds of Columbia University. Professor Lementeur gave a talk to 85 especially selected physicists and scientists at Philosophy Hall just before the actual demonstration of his invention.

He spoke at length of the vast atomic progress of recent years, particularly of the successful liaison between cosmic and atomic powers—his own celebrated discovery. Before 1960 it was impossible to harness atomic explosions and use the titanic atomic forces for power purposes, except in the now antiquated atomic pile, which is cumbersome and inefficient and gives off dangerous radiation. His cosmic-wave generator, coupled to a standard rapid-atomic disintegrator engine, now changes our entire power concept. The combination of the two engines achieves two important new functions. First, the cosmic engine, working at 20 billion electron volts, turns its primary power into quanta, i.e., mass. This in turn completely absorbs and neutralizes all gamma rays of the atomic engine, thereby for the first time eliminating all dangerous radiation from atomic reactors.

Professor Lementeur sees many practical applications for his discovery in every imaginable field, such as pocket atomic watches, atomic-powered bicycles, automobiles, airplanes, and many other uses.

THE COSMATOMIC FLYER

At 4 p.m. yesterday before the assembled scientists who had come from the four corners of the world, he demonstrated a spectacular new application of his invention.

Here, the scientists and the press, standing on Columbia University campus, saw the new and revolutionary cosmatomic flyer. This is a special array of two miniature cosmic-atomic reactor engines, built so that it can be strapped on a man's back by a special rig and harness. The two engines made of silico-titanium are less than a foot long, with a diameter of about six inches. They are connected by means of a titanium pipe strapped to the back of the flyer. On the flyer's back and attached to the horizontal pipe link that connects the two reactor engines is the heart of the reactor, a silico-titanium round casting in which the power is generated. This casting is well insulated with cellular asbestos so heat loss is at a minimum. The two engines can (*Continued on page* 59)

SCIENCE

The Evolution of the Spaceship

by LESLIE R. SHEPHERD, Ph. D. and A. V. CLEAVER, F. R. Ae. S.

The problems and possibilities of space travel have been reviewed with mounting seriousness in recent years. One of the more elaborate of such speculations appeared in Collier's *for October 18, 1952 and featured the ideas of Dr. Werner von Braun on the technical and financial aspects of constructing a jet rocket capable of reaching the moon. In the following article, two British rocket authorities question the plausibility of several of Dr. Von Braun's contentions.*

THERE are probably as many different shades of opinion as to how spaceflight may best be brought about as there are people anxious to achieve that result. Thus, while the present writers are just as enthusiastic believers in the interplanetary idea as Dr. von Braun or any of his COLLIER'S or Hayden colleagues, they are in considerable disagreement with him on a great many points.

This is not to say that many of the detailed proposals submitted by von Braun are not of enduring value. For example, his emphasis on techniques of refuelling in circular orbits not far beyond the Earth's atmosphere limits, and of low acceleration flight between such initial orbits and the destination planets, concerns important ideas likely to prove very valuable in the development of interplanetary flight. Also significant is the fact (which he points out) that any ship required for operation only in outer space need not be inhibited in its design by any considerations of aerodynamic form. The sleek streamlined torpedoes of older science-fiction, with their rows of gaping portholes, are unlikely to materialize. However, it is quite possible that future models will be more photogenic than the von Braun-Bonestell model; which consist of a naked assembly of girders and gasbags. Cylinders and hemispheres are good structural forms for pressurized vessels, and an outer skin might make a very useful shield against small meteorites—as Dr. Whipple, one of the COLLIER'S writers, was the first to explain.

The first major point on which issue might be joined with the COLLIER'S panel of experts, concerns their emphasis on the military value of space-stations and lunar bases, particularly as sites from which guided missiles could be launched against terrestrial targets. There very probably will be secondary military uses such as short-wave radio relay stations and observation posts, but the suggestion that missiles should be transported into outer space, merely to be thrown back to Earth, looks suspiciously like an attempt to play a confidence trick on the currently "Secret-weapon-conscious" military mind. Its protagonists may argue that good would ultimately come out of this further example of the prostitution of science to war, but it is doubtful whether the Pentagon will be taken in. If one half of a "civilization" succeeded in establishing Earth-satellite vehicles, then the other half would find it easy to produce missiles capable of destroying them in their regular, predictable orbits.

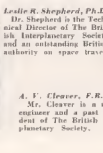
Von Braun quotes the cost of establishing his vast space-station, 1,075 miles above the Earth's surface, as four billion dollars. Again he estimates that five billion dollars would pay for an expedition by three giant 4,3700-ton spaceships, to land 50 men on the Lunar surface and return them safely home. All these figures, large as they are, assume that the expensive lower steps of the dozen or more rocket craft, supplying the space station and refuelling the space ships, would be recoverable for repeated use. Even if some ten percent of these unpiloted components were lost as a result of their parachute descents (probably a very optimistic assumption), then the cost of the Lunar expedition, would probably be increased by order of magnitude.

In any case, the first COLLIER'S article suggested that the surface-to-orbit rocket ships, with an empty weight of nearly 1,000 tons, would probably cost "less than one million dollars" each. Those familiar with aircraft costs, per pound of weight, will realize how wildly unrealistic this is, and agree that the true figure might even exceed fifty million dollars! If this figure, and comparable ones for the Lunar spaceships, were inserted in the calculations, then the already large costs would become astronomically great, especially after allowing for losses of some of the lower steps, and it would then no longer be arguable that the main expense would be of propellants.

It was also suggested in the COLLIER'S articles that the grandiose space-station could be established by 1967, and the landing on the Moon by 1977. Any scientist or engineer concerned with large-scale research and development projects should agree that these dates, respectively only 15 and 25 years from the present time, are hopelessly optimistic. The complete design, development and introduction into service, of only a relatively small quantity of large modern jet bombers or transports, takes nearly ten years, even with the highest priority devoted to the project. Is it conceivable that these vast interplanetary projects, involving much more radical techniques and far more research and experimentation, could be completed within a time-scale less than three times longer? One feels that this is possible only if some fundamentally new discoveries or inventions come to our rescue; certainly not by the pedestrian application, on a grand scale, of existing basic knowledge, as von Braun claims.

Detailed figures of the performance of the hydrazine/nitric-acid motors, which are used in von Braun's rockets, are not given in the COLLIER'S features, but they may be found in his book, *Das Marsprojekt* (Published 1952 by Umschau Verlag, Frankfurt-am-Main, Germany.), where more or less identical vehicles are described. According to the information given in

Leslie R. Shepherd, Ph.D. Dr. Shepherd is the Technical Director of The British Interplanetary Society and an outstanding British authority on space travel.



A. V. Cleaver, F.R.Ae.S. Mr. Cleaver is a rocket engineer and a past president of The British Interplanetary Society.

this book, the motors may be expected to develop a specific impulse of 285 seconds (i.e., pounds thrust per pound per second of propellant consumption). This is a very high performance for such a combination of propellants and is only attained by adopting extremely high expansion ratios. Such ratios would require heavier nozzles of proportionately greater length and exit/throat area ratio, than those drawn by Bonestell and Klep in the magazine illustrations. The overall performance, of course, would be very critically affected by even a slight deficiency in the specific impulse practically obtainable.

In any case, some confusion seems possibly to have occurred in the portrayal of the motors in the COLLIER'S drawings. Those for the Lunar spaceships are shown as being of a much larger geometrical size than can be inferred from the text of *Das Marsprojekt*. Certainly, with a power plant assembly of the proportions illustrated, it is difficult to believe in the weight breakdown quoted. The Lunar spaceship design, with a total weight of 4,370 tons, is said to carry nearly 800,000 gallons (i.e. nearly 4,300 tons) of propellants. In other words, an allowance of somewhat less than one hundred tons has to accommodate the weight of thirty large rocket motors (giving a total thrust of several hundred tons), of the crew of twenty men, and of all the structure of the huge ship-girders, tanks, pressurized spherical living quarters, instruments and other equipment! Only a glance at the excellent drawings by Bonestell, Klep and Feeman, impressive though they are, is required to raise doubts as to the plausibility of this.

The earlier COLLIER'S article describes the winged, three-step, surface-to-orbit vehicles in even more detail. These again are more or less identical with the comparable rockets, that is, for similar duty, in *Das Marsprojekt*. From all the data given, it is apparent that the various steps are required to have, as percentages of their fully-fuelled weight, an allowance of only about ten per cent for structure and power plant groups. A comparable figure, for the German V-2, is over twenty per cent and the reduction of this value to less than half would tax the ingenuity of any designer very severely.

In brief, while it is not suggested here that any of von Braun's figures can definitely be shown to be impossible, *nevertheless it is quite certain that they have only a marginal possibility of attainment*. It cannot be overemphasized that even a small increase in the structure weights assumed would enormously affect the whole feasibility of the scheme, just as would a small decrease in the specific impulse, as already pointed out. Any shortcomings in these directions would immediately be reflected as further large increases in the cost.

One is led to question whether such huge and elaborate vehicles are really likely to be ever employed for the tasks involved. To suggest that they might be, could even delay the actual achievement of space-flight, the very opposite effect to that desired by von Braun and his colleagues. The taxpayer and the governmental agencies responsible for spending his money may well respond by arguing that, on such a showing, the whole idea is impracticable and beyond the available resources even of a nation as rich as the United States, if not the resources of the whole world. Such a point of view was indeed put by Milton W. Rosen (U.S.N.R. Lab. Director of the "Viking" rocket project), at the Hayden Symposium. The present writers are very sympathetic to a great deal of his "Down-to-Earth View of Space Flight".

Instead of attempting to persuade authorities to sponsor the development of vast, and exceedingly uneconomical spaceships, by voting immense capital sums more or less all at once, it is far better to ask them for more modest amounts, over a longer period, with which to discover how to build smaller and more efficient vehicles to do the same job.

The present authors believe that the evolution of the spaceship will, in fact, follow in the stages outlined below:

1. The next decade will see constant progress in the development of rocket propulsion for supersonic aircraft, guided missiles and research rockets capable of attaining heights of several hundred miles. All this work, though constructed for other purposes, will provide essential data contributing towards the eventual achievement of space-flight.

2. Toward the end of the above period, sufficient practical experience should be available to permit the construction of small unmanned Earth-satellite-vehicles, multi-step orbital rockets telemetering the readings of their automatic instruments back to Earth. These rockets will use conventional chemical propellants, perhaps even the hydrazine/nitric acid combination considered by von Braun, though there is a strong case for using still more powerful systems if possible. The incentive for such a project, in the first place, will be provided by pure physical research; e.g., the measurements of cosmic ray intensities at various latitudes, over relatively long periods of time. The first artificial satellites of this type will probably be set up around 1965.

3. Some years after this, perhaps by 1975 or so, relatively small piloted satellite rockets will be in operation. Again, they will be used for research, perhaps also for military reconnaisance and radio purposes, e.g., the guidance of long-range unmanned ground-to-ground missiles, operating at lower altitudes. As they are developed into larger sizes, they will almost certainly be used as commercial short-wave radio relay stations, for television and communication services.

   These rockets will still use chemical propellants, but these will need to be the most powerful available combinations, with hydrazine, ammonia, or hydrogen as fuel, and oxygen, ozone or fluorine compounds as oxidants, giving specific impulses of between 300 and 400 secs. With such vehicles, techniques will be developed in what might (with apologies to Stephen Potter!) be called "spacemanship". Flights penetrating several thousand miles into space will be carried out by human crews consisting of not more than two or three men; perhaps a few such expeditions will even conduct circumnavigations of the Moon, but without landing.

   All this will take us well towards the end of the present century, into the 1980's or 1990's. If the Lunar landing, and expeditions to the other planets, still have to be made using natural chemical fuels, then a lot more time will have to pass before an agency is prepared to put up the large funds required for such an extravagant purpose.

4. However, while all the above developments are taking place, the rest of science and technology will not be standing still. Stimulated by motives very different, in most cases, from any desire to achieve interplanetary travel, fundamentally new discoveries and inventions will be made. A real hope of reasonably economical voyages to the Moon, Mars or Venus, within half a century from now must arise from applications of such new principles.

   Perhaps new metastable fuels, much more powerful than our present chemical propellants, may be prepared under physical conditions which have not been obtainable hitherto. A way may be discovered to stabilize liquid non-atomic hydrogen, giving specific impulses of the order of 1000 secs.

   Nuclear energy may be used in rocket motors, with reactors in the chambers heating inert working fluids (hydrogen, ammonia or even water) for expansion through the propulsive nozzles. Better still, it may become possible to generate electrical power directly from nuclear reactions, and then use it to accelerate a beam of ions to form an extremely high-velocity rocket jet. Maybe the physicists will even discover the means to realize the old science-fiction dream of directly manipulating gravitational fields, in which case the space-flying rocket might be completely superseded after all.

This reference to science-fiction is an appropriate note on which to conclude this discussion. Such possibilities as those listed in item 4 above may seem today to belong to the pages of fantasy and science-fiction, but readers of this magazine, at least, should be prepared to accept the probability that the future will bring some radically new developments, and not merely extrapolations of present practice.

By 2000 A.D., landings on the Moon and perhaps the nearer planets may well have been made, but to the people of that era, it is likely to be the 1952 proposals for giant, chemically-fuelled spaceships which will seem fantastic in retrospect.

SCIENCE NEWS SHORTS

astronomy

Daytime Fireball

ALTHOUGH meteors are seldom visible in daytime, a brilliant one was observed by 74 members of the American Meteor Society on July 7, 1952. The meteor was observed from points 500 miles away from its spectacular flight. It was named *Sunshine Fireball* and was said by some observers to have been as bright as the Sun. No sound accompanied the appearance of the fireball and it was visible for only a few seconds. The estimated ground path of the fireball was 100 miles, the meteor having come down at a very steep angle. The display was seen in the Pacific Northwest; the luminous part of the path started over the northwestern corner of Utah and it ended approximately 55 miles east of Twin Falls, Idaho.—*Sky and Telescope.*

Jupiter's Spots

THE spots observed on the planet Jupiter are now believed to be high-level storms, triggered by the same solar flares that cause upper atmosphere cyclones in the Earth's atmosphere. Dr. Yale Mintz, meteorologist at the University of California, in observations at the Lowell Observatory, found that the spots tend to form a few days after strong solar disturbances, appearing more often during years of maximum solar activity. Jupiter's upper atmosphere apparently absorbs solar radiation, and storms develop.—*Science Service.*

astrophysics

Solar Heating

ABOUT 1 horsepower (746 watts) of solar energy is received per square yard of exposed earth surface. One of the new buildings of the Southwest Research Institute on Essor Ranch, San Antonio, Texas, will be heated by solar energy. The installed apparatus will be used for research as well as practical purposes. A heat-storage reservoir will supply heat on cloudy days when no solar energy is received. One of the simplest methods thus far for utilizing solar energy is to heat water to about 150° F. Higher temperatures may be obtained with the aid of special equipment to focus and concentrate the sun's rays. To heat water, only a simple apparatus is required, with no moving parts. Solar energy power units are best suited to installation in regions having a minimum of cloudy days, such as the southwestern areas of the United States.—*Science News Letter.*

Velocity of Light

THE velocity of light is an important basic measurement used by all scientists and engineers. It has been assumed that light travels at approximately 300,000 kilometers per second (about 186,000 miles per second). Recently, new measurements of the velocity of light, made on a base-line of 6 kilometers (3.72 miles), were reported by Erik Bergstrand of Sweden in *Arkiv för Fysik*, a publication of the Swedish Academy of Sciences. The mean value of several measurements was given as 299,793.1, plus or minus 0.2 kilometers per second. This constant is of evergrowing importance to all those making measurements in optics and radio transmission.—*Sky and Telescope.*

atomics

Radioactive Waste Disposal

RADIOACTIVE wastes or "ashes" from atomic production plants cannot simply be thrown into a river or a dump, as they are liable to injure human health. Various plans are being developed to solve this serious disposal problem. A device that will incinerate the waste products is now being built. At Brookhaven a plan to *fix* the radioactivity or concentrate it in natural clays has shown promise. At present, much of this dangerous waste is being stored in tanks or underground concrete reservoirs until its radioactivity may die down to a harmless point.—*New York Times.*

New Uses for Atomic Power

MANY new applications of atomic power were cited recently by Paul C. Aebersold, director of the Isotopes Division of the Atomic Energy Commission, before a New York meeting of the Clothing Manufacturers Association of the U.S.A. Among applicable, valuable uses that he cited were: Use of atomic radiation and atomic heat to induce chemical and physical changes in materials, use of radioisotopes for the study and measurement of the penetration of dyes into fabrics, selection of improved cleaning fluids, analysis of synthetic fiber production, development of improved textile lubricants, and help in solving the problem of minimizing static electricity collecting on looms and similar machines.—*New York Times.*

Atomic Effect on Photo Poper

UNLESS photosensitive print papers are specially packaged to prevent "fogging" from radiation carried through the air from atomic bomb blasts, they can be ruined. A recent report says that the atomic bomb tests in Nevada fogged photo paper 3,000 miles distant, in East Coast plants. This was reported by Dr. W. A. Schenk, superintendent of Riegel Paper Corp., at a conference of the Packaging Institute in New York City.—*New York Herald Tribune.*

Atomic Power Production

AT the Oak Ridge National Laboratory a new type of reactor started operation last spring. In this reactor the fissionable material takes the form of a mud-like sludge. Electric power is produced by an experimental plant in the new installation. The method of handling the plutonium or uranium "fuel" in fluidized form is being studied. Atomic electric power was first produced by the AEC experimental breeder reactor at Arco, Idaho, last year.—*Chemistry.*

chemistry

Chlorophyll as a Deodorant

THE role played by chlorophyll in Nature is well known to chemistry students, but its widely advertised virtue as a body deodorant is open to question. An estimated fifty million dollars will be spent this year on chlorophyll products, advertised as effective for obliterating objectionable odors from one's mouth, feet, armpits, etc. Some experts assert, however, that the chemical effects of chlorophyll on the living organism deserve further investigation.

Among the *claims* for chlorophyll are that it prevents or checks cavities in teeth (when added to a toothpaste), removes body odor from armpits (some tests failed to confirm this). It seems *partially* to check body odor in dogs when added to their food. It also seems to deodorize foul-smelling sores when applied in an ointment. However, thorough scientific tests to show actual efficacy of chlorophyll as a deodorant, and its biologic effects on the human body are yet in process of being completed.—*Consumer Reports.*

Fluoridation of Drinking Water

TO fluoridate drinking water—or not to fluoridate—that is the question confronting many city and town water authorities. Some reports appear to show that tooth decay is reduced where the drinking water is fluoridated. However, it will take some time before conclusive evidence in its favor is finally adduced. J. L. T. Appleton, Dean, School of Dentistry, University of Pennsylvania said: "Any present judgment of the value and safety of this method (fluoridation of drinking water) is tentative. Therefore, to advocate it, except as an experiment, is premature and uneconomical." A gainful" An official report by the Special Committee on Fluoridation of the New Jersey Section, American Water Works Assoc., says in part—"Authoritative sources have publicly cautioned against a premature promotion or adoption of artificial fluoridation until such time that adequate and convincing evidence has been presented."—*Consumers' Research Report.*

Conversion of Coal into Gas

A SYSTEM for converting coal directly into gas has been patented by L. L. Newman and W. C. Schroeder. The gas is produced from the coal while it lies, unmined, in the ground. Incomplete com-

bustion of the coal or ignition of the gases underground are avoided by the new process. Combustion supporting gas, such as air, is fed into one of two rows of holes drilled into the coal seam. The gases produced by the burning coal are collected from the second row of holes. Small holes are drilled between the large processing holes and can be used for introducing non-burning "sealing-off" agents, to separate the gases from the oxygen and the burning coal.—*Chemistry.*

Oil Direct From Coal

DIRECT production of a heavy crude oil from coal, while it is still underground, unmined, has recently been patented. This new technique eliminates the cost of mining, of transportation, and of grinding the coal into fine powder. Crude oil thus produced can be pumped to the surface to be further refined into suitable motor fuels. The patent was issued to E. F. Pevere and G. B. Arnold and assigned to the Texas Company. A hole is drilled down into the coal seam, and a hydrogenating agent is pumped down through it. Oil formed and is collected and piped to the surface. An electric heater may be used to start the process.—*Chemistry.*

Purification of Gases by Uranium

URANIUM hydride has proven valuable in eliminating impurities released from electrodes or walls of vessels such as those in rare-gas discharge tubes. Uranium hydride is heated to approximately 400 degrees C. to drive off the hydrogen, and rare gas is then admitted. The impurities become absorbed. Uranium reacts with practically all gases. Only a few rare ones, such as helium, argon, neon, etc., are not affected by this process, discovered by Drs. G. H. Dieke and H. M. Crosswhite at Johns Hopkins University. A discharge tube previously contaminated in only two days may remain pure for over five months' continuous use when activated uranium is added to it.—*Chemistry.*

food chemistry

Danger in X-rayed Food

X-RAYS, when employed to sterilize foods such as fatty meats, milk, butter, salad oils, etc., may render them unfit for human consumption. Dr. James F. Mead, chief of the Biochemistry Division of the Atomic Energy Project at the University of California (at Los Angeles School of Medicine) has sounded a warning on the use of X-ray sterilized foods. Irradiation by X-rays causes a chain of free radicals to be released, which destroy essential fatty acids and vitamins in many foods. Also, this undesirable effect can cause other substances present to produce poisonous peroxides.—*Chemistry.*

Foods From Fungi

THE world food supply can be augmented scientifically by combining present waste products (potential food substances) with some form of fungi in a fermentation process. Many fungi are grown in large masses on cheap carbohydrate material, such as molasses, vegetable waste, potatoes, and sulfite waste liquor from the wood-pulping industry. Dr. Robinson estimates that one acre of concrete-enclosed pond employed for the propagation of fungi and algae is capable of producing fat equivalent to that yielded by 25 acres of vegetable oil crops. Nutritionally valueless substances can be transformed into high-protein foods by utilizing fermentation by any one of several fungi processes that have been developed so far. Experiment, it is said, has shown the feasibility of transforming wood waste into fungus proteins suitable for animal feed. This indicates promising possibilities for human food needs.—*The Scientific Monthly.*

climatology

Numerical Weather Forecaster

AN ELECTRONIC computer, to be installed at the U.S. Weather Bureau, will forecast the weather conditions over a large area. Data on weather conditions in different parts of the country will be fed into the electronic computer, together with complicated mathematical formulas. Out will come a chart which describes the weather as it would look 24 hours later. Eight charts will be prepared, each covering 24 hours; these will represent eight horizontal "slices" of the atmosphere, beginning at sea-level and expending up to about 1,000 feet. Thus vertical as well as horizontal changes will be indicated on the chart. Most accurate predictions of the weather will be possible with the electronic computer, as the numerical forecasting system can take into account many more pieces of information about weather conditions than a human forecaster can hold in his brain. —*Radio-Electronics.*

communication

Electronic Library

TOMORROW, men may sit at home or in the office, dial a number, and within a few minutes get the answer to any one of thousands of questions. The answer will be flashed on the screen of his television receiver. A centralized library of technical (as well as general) information will store the known facts about thousands of subjects, from ancient historical lore to the latest scientific data. Each subscriber will have a handy index, so that he can instantly dial the number appropriate for the exact information he desires. To start the program, the Chemical Biological Co-ordination Center of the National Research Council indexed every biological and chemical journal since 1946, so that in a few moments one can obtain information on 33,000 chemicals and 40,000 biological reactions. Col. Fred L. Walker, Jr., former scientific information chief for the Army General Staff, envisions an electronic recording cell (he calls it the *Electrocord*), which would store all desired oral or visual information. The data could be instantly played back by television, when the correct index number was dialed. Dr. Vannevar Bush, well-known scientist, proposes an extension of the above idea, which would incorporate a *home library* containing thousands of facts stored on microfilm or on magnetic tape. Answers to questions would appear on a translucent screen. Means would be provided also to store information by means of photography and magnetic recording.—*New York Herald Tribune.*

Titanium-Dioxide Rectifier

SELENIUM for rectifiers is now difficult to obtain, and a new rectifier material (for converting alternating current to direct current) has been discovered. This rectifier is a sandwich made of titanium dioxide. R. G. Breckenridge and W. R. Hosler, of the National Bureau of Standards, state that the new rectifier looks very promising, although titanium is still somewhat expensive. Half-inch squares of commercial titanium sheet metal, only .02 (two-hundredths) inch thick, used in the rectifiers, are heated in steam at 1,100° F. for three hours. A semiconducting layer of titanium oxide forms on the metal. Silver is then deposited on the square sheets, sandwiching in the oxide. Each unit will stand 20 volts, and whatever number of units necessary to handle the required voltage may be combined.—*Science Service.*

Crystal Recorder

CRYSTALS may yet solve some of man's most difficult problems. J. R. Anderson of the Bell Telephone Laboratories claims that barium titanate crystals apparently can store as many as 2,500 items of information within a crystal of one square inch surface and a few thousandths of an inch thickness. The crystal stores electronic impulses for a long time. The pictures may be less than one-millionth second long. The crystal consumes no power while storing the information, and is able to operate on low-voltage circuits. Tiny crystals serve as transistors, which can do many of the jobs that vacuum tubes are now doing. Other crystals experimented with are rochelle salts, potassium niobate, and potassium dihydrogen phosphate.—*Science Service.*

electricity

Atomic Electricity

TO REPLACE wasteful methods of obtaining electricity from atomic reactions by means of steam boilers, turbines, and dynamos, Dr. Ernest G. Linder, of the R.C.A. research staff, has patented a far simpler process. Dr. Linder develops electric current directly from the atomic rays by placing collector electrodes in an evacuated chamber containing the polonium or radioactive phosphorus, etc. Beta rays, for example, traveling between the source electrode and the evacuated collector terminal, cause the latter to become negatively charged. A current flows when a load is connected between the collector electrode and the source terminal. The generator may also use alpha particles. The a.c. and d.c. generators are similar. These electronic generators produce very high voltage which can be transformed down to a lower value.

The loss by first converting atomic energy into steam to drive an engine and dynamo to develop electricity is very high. The Linder method is much more efficient.

An illustrated description of the Linder generators appears in the February, 1953, issue of *Radio-Electronics.*

electronics

Magnetic Tape TV Recorder

WE SHALL soon be able to record television programs, both image and sound, on a magnetic tape—so that it may be reproduced at will, in theater or home. Magnetic reproduction will be much cheaper than the present recording method of photographing TV programs on films. Much time is now lost in developing and finishing photographic film, and the picture quality is poor at best. Within a year or so, at most, magnetic tape recording of TV programs may replace photography and effect a huge saving to the industry.

Recent practical results in recording high-frequency signals encountered in TV work, promise an early solution to the problem. The frequency range necessary is approximately zero to 4,000,000 cycles. The output signal from the magnetic tape can be fed into the amplifier of a TV transmitter, or passed into the video amplifier of a home receiver, the image and sound being reproduced in the usual manner on the cathode-ray tube and loudspeaker.—*Radio-Electronics.*

geology

Water-Witch Statistics

FOR many years the "dowser," or water-witch, claimed to have the power of locating underground water veins by noting the dip of a hazel twig held in his hands. He has puzzled many people. Water often filled the wells dug in the location indicated by the dowser's twig. Sometimes, however, his prediction failed and there was no water. Scientists have always frowned upon the art of the dowser and the latest report seems to prove that there is no science behind his methods. Analysis of many examples of wells dug *with* and *without* the dowser's aid indicates that he is probably self-taught in geology and moreover has a good knowledge of the ground over which he prospects for water. Dr. Evon Z. Vogt reveals that better results were obtained in sinking wells *without* the dowser's aid, than with it. In sinking 1,234 wells located by a dowser, 70.4 per cent showed a good flow of water. Out of 1,406 wells sunk without the dowser's aid, 83.9 per cent were successful. Failure occurred in 14.7 of *divined* wells, but in only 7.5 percent of wells found *without* the dowsers' aid. Dr. Vogt declared that it is impossible for the dowser to note repeated changes in electromagnetic field caused by the presence of underground water.—*The Scientific Monthly.*

inventions

All-Glass Paper

ALL-GLASS paper, composed entirely of glass fibers, has been developed jointly by the Naval Research Laboratory and the National Bureau of Standards. It has several useful applications in spite of the fact that it lacks material strength. The paper is made of matted glass fibers and is particularly well suited for use in filters for gas masks and respirators. It may be able to filter radioactive dust in atomic energy installations. It does not transmit electricity and hence is an excellent insulator. It is highly resistant to the effects of heat, moisture, chemicals, and microorganisms.—*Science Service.*

Robot Milling Machine

A NEW robot device developed at the Massachusetts Institute of Technology for the Air Materiel Command will perform a milling machine operation, formerly requiring hours, in a few minutes. Numbers derived directly from drawings and specifications of the parts to be machined are coded and punched on a paper tape. The instructions may be carried to whatever precision is necessary. Three decoding servos convert the commands of the tape into shaft rotations, which are transmitted electrically to power servos. The power servos control the milling operation. Duplicate parts may be run off on the milling machine at any time, once the control tape has been prepared. Development of the machine was supervised by James O. McDonough, project engineer, under the direction of Prof. William M. Pease, Director of the Servomechanisms Laboratory.—*Radio-Electronics.*

mechanics

Electrolytic Grinder

A NEW method, using a reversed electroplating process, has been perfected for grinding hard steel tools and other metal parts. A simple metal disc serves as the grinder. It has a negative electric charge, and a chemical, like sodium nitrate, is sprayed over the grinding surface. The piece of metal to be ground is positively charged. As the grinding proceeds, small metallic particles flow from the workpiece, and pass through the electrolytic chemical spray to the grinding wheel. If necessary, a little diamond dust (bort) may be added to the grinding wheel to make it work faster. The cost of grinding off a cubic inch of metal on a test piece was reduced from $107 to 76 cents. A kit is available for adapting standard grinding machines to the new electrolytic method.—*Business Week.*

"Flame Plating"

A NEW process of "flame plating" a hard durable metal over an inexpensive base metal has been announced by the Linde Air Products Co. The metal can be *flame-plated* without raising the temperature of the base metal above 400° F. Powdered metals such as tungsten carbide have been used, the process leaving a deposit or coating of from 5/10,000 of an inch to 2/100 of an inch thick. The coating will not chip or peel, and the plate may be used with its natural finish, or polished to mirror brightness. Parts of all desired shapes can be plated by the new method. Metals other than tungsten carbide may be used. The plating has shown wear resistance comparable to that of sintered tungsten carbides, and it is said to be superior to that of hard chrome plating, cast alloys, and even tool steels.—*Business Week.*

medicine

Cure for Cataracts

CATARACTS (clouding over of the lens of the eye) occur frequently in old people. Until recently, the only remedy was to remove the lens by surgery, a delicate and not always successful procedure. A new treatment has been tested experimentally on human patients, whereby the clouded lens in the eye is cleared with injections of an extract made from the lens of a fish eye. This startling and long-awaited discovery was reported (with a table of results obtained with human patients so far) by Doctors R. F. Shropshire, Jacob R. Elmburg, and Mendel Jacobi. The fish lens protein extract is injected several times weekly. In a number of the cases reported, blind persons regained practically normal vision after receiving 30 injections. Most of the patients were between 60 and 70 years of age. This is a preliminary report. Further research is underway.—*Science.*

Artificial Heart Valve

AT LAST surgeons have succeeded in replacing defective valves in the human heart with a man-made mechanical valve. The patient may remain alive and healthy. The only difference one notes in listening to a heart with an artificial valve is a slight clicking noise at each heartbeat. The valve is constructed of a chambered tube one and a half inches long and one inch thick. It contains a small, plastic ball which seats itself against a shoulder inside the tube. When he blood pulses from the heart the plastic ball is forced back, preventing the blood from surging back into the heart. It thus acts as a check-valve, similar to that used in water and other pipelines to prevent reverse flow of a liquid. The artificial heart valve was installed by Dr. Charles Hufnagle, a surgeon at the Georgetown University Medical Center (Maryland), assisted by Dr. John F. Gillespie. The National Bureau of Standards designed the artificial heart valve.—*New York Herald Tribune.*

Human Kidney Graft

WHILE the successful grafting of human kidneys has been performed only experimentally (with temporary functioning of the transplanted kidneys), the day is fast approaching when kidneys and other organs will be transplanted with permanent functioning assured. Three of six kidney transplants to the thighs of patients functioned for some time. After a period of nonfunctioning for 8 to 14 days, the transplanted kidneys started to function. In one case almost 3 quarts of urine were obtained in a 24-hour period. Infection interfered with all of the kidney transplants so far made, but two of them transplanted in humans operated much longer than any similarly transplanted kidneys in animals. These interesting results were reported at a meeting of the American College of Surgeons in New York, by Doctors David M. Hume, John P. Merrill, and Benjamin F. Miller, of Harvard Medical School and Peter Bent Brigham Hospital, Boston. —*Science News Letter.*

New Vitamin for Heart Trouble

ENCOURAGING results in treating heart trouble have been obtained with the new vitamin B-15, according to Dr. A. L. Pettigrew of Long Beach, speaking recently before the American College of Osteopathic Internists in Pasadena. Vitamin B-15 relieved from pain persons suffering from angina pectoris and also reduced their intake of drugs such as nitroglycerine. The new vitamin increases consumption of oxygen by weakened heart muscles and other bodily tissues. B-15, moreover, helps to relieve high blood pressure.—*New York Herald Tribune.*

physics

Six New Superconductors

SIX new superconductors have been discovered by two scientists from the University of Chicago. Superconductors show a marked drop in electrical resistance when cooled to a point approaching absolute zero (-459° Fahrenheit). At this low temperature the molecular structure is realigned, dropping the electrical resistance to a very low value, and making the materials true *superconductors*. Of the six new substances recently discovered, two are nitrides, two are borides, and two are alloys of metals. About 90 different compounds were tested by the researchers, Dr. B. T. Matthias, of Bell Telephone Laboratories, and Dr. J. K. Hulm, of the University of Chicago's Institute for the Study of Metals.—*Physical Review.*

Absolute Zero Approached

DR. DIRK DeKLERK, in experiments made at the National Bureau of Standards, Washington, D.C., reached the lowest degree of cold yet attained—a temperature of only 15/10,000 of a degree above zero on the Kelvin scale. Helium was condensed and cooled by a cryostat to within one or two degrees of the absolute zero (-459° F.) and a salt, which was magnetizable, was rendered equally cold. The cold salt was placed in the field of a powerful electromagnet; the magnetic field aligned the molecules in the salt and the helium refrigerating system carried off the excess heat, producing the record-breaking low temperature.—*Science Service.*

spatiology

Observatory in Space

IF A floating space observatory is ever built, man will learn much more than ever before about the probable evolution of the planets and the makeup of interstellar space. Some interesting aspects of astronomical observations from space were given in a lecture by Dr. Fred L. Whipple (Chairman, Department of Astronomy, Harvard College Observatory), at the recent Space Travel Symposium at the Hayden Planetarium in New York City. A large optical telescope with lens or mirror would be heavy and awkward to handle on a space ship; therefore Dr. Whipple suggested that an electronic telescope, with a photoelectric screen, be employed. With suitable filters such an instrument would have a new range of power far beyond anything we now have. A telescope on a space flyer would have to be manipulated by remote control, to avoid heat and other effects from the human body. Especially interesting will be direct measurement of corpuscular radiation from the sun, the far ultraviolet and X-ray spectra—and variations as correlated with solar activity such as prominences, flares, coronas, etc. A space telescope will also permit complete studies of the chemical composition of all planetary atmospheres; stellar evolution; composition of the interstellar medium and the percentage of almost all its 10 trace-elements. Secrets of the origin of the universe itself may be solved through observations made from such an observatory.—*Astronomy from the Space Station*, by Fred L. Whipple.

Spatial Communication

HIGH-frequency radio-communication across interstellar space, for example, to an exploring party on the moon, was recently described by George O. Smith, Radio Research Engineer of Emerson Radio & Phonograph Corp., at a Symposium on Space Travel at the Hayden Planetarium in New York. Out in space, radio waves travel in straight lines through an absolutely transparent medium. It was suggested that microwaves 1.4 inch (3 centimeters) long (10,000 megacycles frequency) are suitable for communication. A 6-foot reflector might be adequate for getting signals in a concentrated beam toward the moon. Equipment for such 1.4-inch waves is available now. The round-trip passage of radio signals between Earth and Moon requires 2.6 seconds, which time must elapse between question and answer in a radiophone conversation. (For Mars the time-lag would be 6 seconds.) Teletype communication is recommended, as a permanent record of all signals exchanged becomes automatically available. The minimum power required for Earth-to-Moon radio communication is estimated at 0.291 watts, approximately the power used in a 3-cell flashlight. Contact with Mars would require a minimum power of 7,000 watts.—*Radio Communication Across Space*, by George O. Smith.

technology

Tritium Light Standard

THE principal ingredient of the hydrogen bomb is now used as a light source for standardizing phototubes and other optical instruments. The light is almost constant. Tritium, the triple-weight hydrogen, is believed to be essential to the H-bomb. Dr. Irving A. Bernstein and Earl Farmer, of Traerlab, have incorporated tritium into *stilbene*. Tritium's beta rays or electrons, radiated constantly, cause the carbon-hydrogen compound to fluoresce. This light is somewhat like the light emitted by radium-activated substances. It is not, however, dangerous to health. Light from the tritiated stilbene is strongest in regions of the spectrum where the eye is least sensitive, but where phototubes are most sensitive. Self-luminescent materials more visible to the eye are being developed to replace radium on watch dials, luminous markers, etc.—*Science Service.*

COSMATOMIC FLYER

(*Continued from page* 53)

turn in a complete circle. The flyer controls this action by means of several handles on the control panel in front of him. As the thrust of the engines can be directed to every degree of the compass, the flyer can travel in any direction—up, down, east, west, north, south.

The flyer is also equipped with a miniature short-wave radiophone transmitter and receiver. Attached to the control panel on his chest is an automatic map, which unrolls as he flies. This gives him his course. At night the map is illuminated. He wears a standard flyer's double-walled vacuum, plastic dome over his head, which also has an oxygen outlet in case the flyer goes above 10,000 feet altitude. He wears a "Himalayas" type Thermoplex-Insulator suit, which protects him down to -65° Fahrenheit. If necessary, the suit can be heated through a small flexible pipe which connects with the power generator.

The two engines together give a maximum thrust of 550 horsepower, resulting in a cruising speed of about 475 miles per hour, at an altitude of 10,000 feet with a minimum wind.

THE FLIGHT

At 5:40 last evening, Dr. Philo Harris, 32-year-old Columbia physicist, was ready to demonstrate the cosmatomic flyer. The trial course was to cover New York to Philadelphia, 85 miles distant, and return, totaling 170 miles.

At 5:45 p.m., Harris shot rapidly into the air at a slight angle in the direction of Philadelphia. Reddish quanta streams emanated from the two engines in a spectacular display of power, although Professor Lementeur quickly pointed out that the red streams could not be compared with rocket exhaust, as they were not really very hot, *nor were they burning flames*. Rockets, he explained, use fuel, or chemicals that burn, giving off extremely hot incandescent gases. The cosmatomic engine creates its thrust by converting atom-electric energy into quanta—*mass*—which glows with only mild heat.

For the next few minutes, Harris' voice over the loudspeakers gave us a running account of this rapid progress. He quickly passed over Bayonne, New Brunswick, Trenton, and at 5:56, eleven minutes later, he was over Philadelphia, where powerful search-lights, checking his flight, caught him in their cross-beams. He then swooped gracefully over Camden and headed north for home.

At exactly 6:06 p.m. he appeared again over the Columbia campus and landed lightly at 6:06:45 on the exact spot he had taken off from. Total elapsed time: 21¾ minutes for the round trip.

Curiously enough, his ascent and descent were not noisy at all—if you compare the cosmatomic engine noise with a regulation jet. It was more like air escaping from a nozzle under moderately high pressure.

Said Dr. Harris after landing: "I did not use full power on this trip—I think the distance can easily be covered in 18 minutes flat!"

book reviews

The Dogs Take Over

CITY, by Clifford D. Simak. The Gnome Press, N. Y. 224 pages. $2.75.

Clifford D. Simak is one of the three or four most outstanding science-fiction writers who are producing regularly today. It is the simple truth to state that this book, *City*, is one of only several important volumes of science-fiction produced during 1952.

The book is composed of a series of eight interconnected short stories which take the form of so-called legends treasured by the dogs, who eventually attained a high state of civilization after man had disappeared from the face of the earth. Especially for this book, Mr. Simak has written eight prefacing notes, one for each story, containing the views of the dog historians as to the truth of each legend.

The title of the book is derived from the first story in the series, a fascinating tale of the future when decentralization has been virtually completed and only a few thousand people reside in even the largest of cities.

The second story, "Huddling Place," is the prize of the book. With considerable writing skill and fine shading of emotion the author writes of a time after the decentralization of cities, when people have every comfort in their immediate area and leave their zones so rarely that in some of them, a mental fixation sets in against travel. This story reaches a poignant and superbly handled climax when word is received by one of Earth's surgeons, that the greatest of all Martian philosophers has brought into being an entirely new concept of life which will advance man's progress 100,000 years at one stroke, but that he, the Martian, is dying of a brain tumor, with the necessary work on the new philosophical concept not yet completed. Only this one Earth doctor has the combined skill and knowledge of Martian anatomy to save him. The doctor's frantic preparations for the trip, his urgent desire to go, since the Martian philosopher is an old and dear friend of his, and the final realization that he is mentally incapable of leaving his home area, is believably portrayed.

In the stories that follow, the author delineates the future history of mankind with concepts such as the development of free-will robots; the advancement of science to the point that man is capable of building new bodies adapted to the conditions on other worlds; the coming on the scene of human mutations of tremendous ability but nihilist ambition; the gradual attainment of mechanical progress in the ants; the emigration of the dogs to other worlds; and the ascendency of the dogs.

It is a book of genuine achievement in science-fiction, made doubly so by the fact that in addition to the great imagination shown by the author in his portrayal of the scientific advancement and the sociological and psychological changes of man, he is a writer with real pride in his work. The great care he has taken in his writing, and his striving for higher standards of excellence is evident.

Flying Saucers—The Opposition

FLYING SAUCERS, by Donald M. Menzel. Harvard University Press, Cambridge, Mass., 1953. 319 pages. $4.75.

Amid the many books and articles appearing on the subject of flying saucers, Dr. Menzel's is outstanding. It is written by one who has himself seen objects in the sky which might be loosely interpreted as flying saucers; a man who is willing to admit that observers are seeing *something*, but nevertheless is determined in viewpoint that all sightings are *natural* phenomena, whether known or as yet unknown. He is ably qualified to give plausible explanation since he is highly regarded internationally as a scientist, and is at present acting director of Harvard College Observatory. Dr. Menzel approaches the flying saucers from a scholarly viewpoint, showing a background of considerable research. He writes with great clarity, disdaining obscure and high-sounding phrases.

There is a great deal of information here, that is new to the reader of past flying saucer treatises. Dr. Menzel has delved into musty old files and has come up with entire chapters on the flying saucer scares of 1882 and 1897; the unknown lights seen in Japan; and references to moving objects in the sky as far back as Biblical times.

He does not duck any of the strong, well-authenticated sightings; he dissects them scientifically and plausibly.

The psychological attitude of the American people, displaying their willingness to believe even incredible, fictionized reports, is explored in great detail in a chapter devoted to Orson Welles. His famous radio program "The Invasion from Mars," in 1938, caused a panic quite analogous to the fear initiated by the flying saucers.

An outstanding feature of the book is the 50 pages of photographs (spared through the text) related to the subject discussed, reproduced with the care and fidelity that has become a specialty of the Harvard Press.

This is one of the more worth-while books on the subject of flying saucers that have been produced so far and is a welcome antidote for those volumes whose chief appeal lies solely in the realm of sensationalism. It might well be considered a cornerstone volume on the subject.

Space Flight for the Millions

THE EXPLORATION OF SPACE, by Arthur C. Clarke. Harper Bros., N. Y. 199 pages. $3.50.

The high measure of the extent to which space travel has seized the imagination of the American public becomes obvious when one finds that a book on the problems of space travel is a joint selection on the Book-of-the-Month Club's lists.

Arthur C. Clarke, the author of this book, is the Chairman of the British Interplanetary Society. Science-fiction stories, ranging in lengths from short stories to novels, written by him, have appeared in many of the popular science-fiction magazines here and abroad the past five years. In addition, he has had published two books: *The Red Sands of Mars*, a science-fiction novel, and *Interplanetary Flight*, a volume similar in subject matter to his present work.

The book is intended to be popular and gives complete and adequate coverage of the subject for the neophyte. However, those who have read previous volumes on the subject, including Mr. Clarke's own writings, may have to search hard for scraps of new information.

The importance of this book lies in the fact that it may help educate the mass book-reading audience into more readily accepting the framework upon which many science-fiction stories are constructed. It is, in a sense, a pioneer book, successfully introducing the basics of science-fiction to a new readership. For this fact Mr. Clarke deserves admiration.

The book contains 14 plates, some in full color, executed by Leslie Carr and R. A. Smith. These plates do much to enhance the volume.

The Last of Weinbaum

THE RED PERI, by Stanley G. Weinbaum. Fantasy Press, Reading, Pa. 270 pages. $3.00.

The day that one of Hugo Gernsback's old science-fiction magazines appeared, carrying the first story by Stanley G. Weinbaum, entitled "A Martian Odyssey," was a red-letter day in the annals of science-fiction. It is truly incredible that a young man, whose active writing career in science-fiction lasted but two years, made such an overpowering impression upon the readers. After his death, there were many imitators, but none of them was so outstandingly successful. They could copy the superficial devices of his stories, the fast dialogue, the original alien life-forms, his style of love interest; but mere utilization of his props did not constitute a successful imitation. Stanley G. Weinbaum had that little extra that comes from within a writer and which cannot be duplicated.

This collection of his stories puts all of his work into book form, with the exception of one non-fantasy short-short entitled "Graph" and a few poems and fragments.

Possibly the best story in the volume is also one of the shortest. That one is entitled "The Brink of Infinity" and is a remarkable and rare example of an excellent and well-executed interesting science-fiction story written entirely about a mathematical puzzle.

"Proteus Island" has a strong plot based upon uncontrolled mutation of animal and plant life.

Every story in the book, under the magic of Weinbaum's unique style, is readable and entertaining.

The book is hand-somely printed and bound as are all Fantasy Press books, and is well worth the asking price.

EXPLORATION OF MARS

(Continued from page 11)

There is only *one* underground city for the 2 billion Martians, but it is enormous. A mile down, it runs through thousands of miles *continuously under the entire subsurface of Mars.* Only about 600 miles near the poles are subcity free.

This planet-wide city has vast cavelike, domed roofs with no visible supports. This artificial sky is smooth and pale-rose colored. Artificial suns fed by cosmatomic energy light the streets and houseblocks so brilliantly that you have the illusion of being on the surface of Mars at noon. The artificial suns also simulate the real sun's high ultraviolet radiation, without which the Martians could not exist.

The temperature never varies in the vast underground city; the air is filtered and ozonized—there is no accumulation of dust at any time. If dust appears from wear and tear, it is immediately removed by electrostatic suction. There are vast parks, immense recreation centers, and amusement arenas every few miles, in all directions.

Varispeedbelts

Yet there is not a single passenger vehicle in the streets—ever. Below the city is a complex transportation system of fast-moving *varispeedbelts*, which take you into any direction. For freight deliveries there is a special system of subspeed belts with outlets under every city houseblock. Nor do you have ever to mount or descend steps. On every city block there are endless inclined *ramp-belts* which take you from the street directly to the varispeedbelts. The latter are never used by Martians to travel further than about 20 miles. For greater distances they ascend to the surface, and travel by transparent flyer.

The houses themselves are huge translucent blocks about 3,000 feet square, vaguely similar to earth apartment buildings. The houseblocks are uniformly terraced, never more than 10 stories high.

The moving strip already mentioned took our party rapidly underground, and we alighted near one of the huge houseblocks. We stepped inside (there are no "doors" on Martian underground houses) and onto an indoor inclined moving belt which quickly took us up five stories. Here we stepped on still another horizontal belt which took us down a long hall, brilliantly lighted.

Stepping off near a curious luminous marker, we found ourselves in a spacious sort of foyer. A panel moved automatically to reveal a very large, beautifully illuminated room. *It was, however, completely bare.* The floor was pleasantly soft and warm; yet there was neither rug nor carpet. The walls and ceiling continually changed in an incomprehensible manner in color, in design, and seemingly in perspective too. All this was pleasing, but puzzling. Later we realized that it had something to do with Martian esthetics, but they could never make us wholly understand.

The "Fluid" Home

Quipped one of them: "You are still children in esoteric culture. Besides, you lack several of the senses needed to understand most things Martian."

We were still standing at one side of the bare room when our leader began to wave his antennas in a curious manner. Suddenly openings appeared in the ceiling and walls. Within seconds all sorts of furniture had been moved into the room as if by magic—enough to seat all of us.

At the same time several walls pushed in from two sides, making a comfortable medium-sized livingroom. The new panel walls cut up the huge room into a complete apartment. Besides seating furniture, many other strange pieces followed—tablelike objects, cabinets, couchlike pieces, and others.

We now walked through one of the mobile walls and found ourselves in a "bedroom." More of this further on.

We finally understood that the Martians accommodate their apartments to the size of their families. You can transform your home in the twinkling of the eye; you may have a ballroom or a cozy livingroom or a gymnasium or a game court —or a theater, all within seconds. If you have many guests, you can have a temporary large livingroom. If you are alone, you may have a tiny one with only the furniture required for that evening or day. Your home thus becomes "fluid," as the Martians term it, never static. With such immense variety, one never gets bored with one's habitation.

You never raise a finger to transform the bare room into the most elaborate apartment. All the furniture is stored in the wall recesses. By telepathelectro control, the Martian brings out any room article he requires at a second's notice. He reverses the process, storing the furniture, whenever he so desires it.

There is practically no cleaning in such a home, as there is no dust. As soon as the furniture is stored in the walls, a powerful electrostatic vacuum suction is applied, which catches even the tiniest speck of dust.

An Ancient Crime

Our reference to crime on Mars was highly amusing to our mentor. There has been no recorded Martian criminal case during the past 950 million years! "Where do you think you are—on earth!" quipped the leader. "Remember, we have telepathic organs—and someone in the population would surely detect any criminality. The last known projected crime did not succeed. This individual intended to take *two* baths, in the 60-day period, instead of the lawful one! You know by this time the importance of water on this planet—and that makes an illegal bath a highly criminal act.

3,000-Year-Olds

The Martians have had a very high culture for over 1½ billion years. Having conquered practically all diseases and solved the main aging processes, they live for thousands of years (earth years). A very small minority of Martians are over 5,000 years old. The preponderant age is 3,000 years—yet one cannot distinguish a 50-year-old from a 2,500-year-old. *There are no age-ravages such as we have on earth.*

But the planet cannot support more than 2 billion Martians, due mainly to deficient water and food supply—but also to insufficient living space. Hence new births are strictly controlled by the *National Health Control.* Martians die only rarely by accident, and mostly by euthanasia. At his or her 3,000th birthday, the Martian, having fulfilled his destiny, is put to death painlessly, to allow for new births by *voluntary selective breeding.* This improves the race.

Martian Surface City: Revolving skyscrapers with round domes; "porcupine" sand-storm dissipators in background; transparent "cheesebox" flyers overhead. Food-culture pipes cut across city; solar heat collector in foreground. Martian skies are nearly black in daytime due to rarefied atmosphere. The sun is brilliant in dark sky.

A number of exceptional personalities, such as scientists, inventors, and those having rendered extraordinary services to the race, may be allowed to live 5,000 years and more. In order to do so, however, the candidate must have a popular vote in excess of 60% of the entire population. Martians never lose their fertility; females can give birth up to the end of their long lives.

Transplanted Heads

We were told that successful transplantation of Martian heads had been practired for some 150 million years. During our stay 280 heads were transplanted for such reasons as scientific research, selective-breeding purposes, accidental maiming (loss of arm, legs, etc.) In this case euthanasia candidates are selected by the National Health Control who transplant the head of the maimed individual onto the body of the Martian about to be eliminated.

Transparent Martians

One of the main reasons for Martian longevity was the invention of the *translumiscope*—far more efficient than x-rays, which give only shadows. By means of this instrument a light source far more powerful than the sun, but giving out *cold* light, is directed on any desired part of the patient's body. With correct focusing, the instrument will transilluminate any organ selected within the body. The light source is so intense that it easily penetrates and illuminates the deepest bodily recesses. By means of special, sensitized, focusing eyepieces, the physician can actually see every living organ within the body. He can see all the blood vessels—inside and out, the interior of muscles, nerves, and even the marrow of the bones. Any irregularity, any pathology of the organ can thus be clearly seen and then treated accordingly. Fevers, infection processes, are easily seen and followed through the blood stream and any part of the body.

Martian Females the Deadlier

The Martian female is about 6 inches shorter than the male, her average height being 9½ feet. She also has, from the human viewpoint, a more shapely waist than the male. Her outstanding characteristic, however, is her double antennas; she has four of them in contrast to the two of the male. She also makes different sounds than the male. Martians of course cannot speak like humans due to the thin air on Mars—they give off curious bird-like, high pitched sounds.

When we asked our leader the evolutionary reason for the female's double antennas, he twittered so loudly and audibly that I could hear it over my plastex helmet phones. Quipped he:

10[15]-26-95989-59

"The double antennas allow her to double-talk better! This confuses the male better too!" A humorous remark, which we found out later, was not without a good deal of truth.

Indeed, the females on Mars are the *REAL* rulers. They hold all the important positions of the entire planet, and the highest council, the *Planet Conclave* is composed of five *Universal Judges*, all females. This is the supreme authority on Mars, the titular head of the two billion Martians.

The quintuple Conclave members are elected for life. The law, however, allows no member to be elected until she has reached her 2,000th birthday. This gives the new co-ruler 1,000 years of office life.

The Martian female has an average of 1½ children. She seldom has her first child before she has reached the age of 1,500 years, because, by law, she cannot have offspring until her turn comes.

The Marriage Scientific

All marriages are scientifically arranged; no one just falls in love and marries. All candidates are selected *first* with a view to bettering the race. Then comes a long list of 129 tests which the intended couple must pass. A single failure on any one test may disqualify one or both candidates. This, however, happens rarely because Martians have been scientifically bred for so many thousands of generations that today there are few physical differences in the race.

Her 129th Divorce

Due to the longevity on Mars it is not at all surprising that the average marriage lasts "but" 473/9 (earth) years. Long as this seems to earthlings, remember that Martians are on a much higher level intellectually and culturally than humans. Martians can marry any time after their 30th year—but no children may be born till the couple's serial rotation number comes up. They may terminate their marriage (divorce) by mutual consent before a special *Dissolution Court*. Recently No. 10[15]-26-95989-59, female, age 2,869 years (a canal researcher), obtained her 129th divorce—not a record by any means.

Marriage Considerations

On Mars people rarely marry for love or sexual attraction. This is indeed for down the list of reasons. The prime motive is intellect. The female always searches for superior intelligence, for accomplishments, for ability. It is the female who woos, never the male.

When she has made her choice, then she and the intended must submit to the State tests. These passed, the couple may then marry immediately. The male has no choice in the marriage preliminaries—if he is chosen, he cannot refuse (unless he is already married).

The females, however, don't have everything their way. Frequently when their dominance becomes too great, the males go on strike *en masse*—millions of them refuse to make love to their wives! The last "sex-strike" 14 years ago, involving over 2½ million males, lasted 5½ years. The males won!

Head Transplant

The Translumiscope

Sleepless Martians

For more than 1½ billion years the Martians have not slept. Early in their evolution they decided that the race must end the intolerable condition whereby the population wasted one-third of its life in useless and unproductive slumber.

Their scientists already had found that certain individuals could get along with much less sleep than others. As a first step these persons were carefully dissected after death. It was discovered that they had slightly different adrenal glands than normal persons. These glands secreted into the bloodstream an unknown hormone X, which is now known as the *antimorph* (anti-sleep) hormone. It simply neutralizes the toxic, acid substances which are created in the body by fatigue and thus induce sleep.

The second step was to mate by *voluntary selective breeding* all the known sleep-resisting individuals. Successive generations—as expected—needed less and less sleep, until finally they no longer needed sleep at all. The modern Martian now has separate antimorph glands, located near the adrenals. This allows him, not only to go without sleep forever, but also to do an astounding amount of physical work, when necessary, without collapsing. But during such an emergency he must ingest more food pellets to balance his caloric output.

Of rourse, the Martian must relax sometime during the day; he cannot go at top speed forever. He relaxes simply by retiring to his restroom—we would call it a bedroom. He has such rooms at home or wherever he toils.

Martian "Bedrooms"

These are plain spherical rooms bare of furniture. The wall and ceiling are (to us) weird, with their peculiar, chameleon-like colors which are forever changing in tone. The pastel-like colors constantly mix in ever-changing hypnotic patterns, never to repeat.

To Martians this is delightfully restful. When they watch these curved walls, they confess that their normal thinking processes stop entirely—they now must relax completely. During the entire rest process their eyes never close once. They gaze as if transfixed at the wall or ceiling.

Not even the slightest sound can penetrate the walls of these restrooms; they are as quiet as the tomb. Furthermore, when in use, the room is "insulated" with a "screen" of a special cosmic wave-form which completely cuts off all telepathic thought waves.

Finally, the body must relax too—*COMPLETELY*, in every sense of the word. When the Martian enters the restroom, he bends backward and places his head on a headrest mounted on an upright slimy pillar. He next fastens a straplike band over his forehead, between his nose and his antennas. Then he presses a button attached to a projecting timer on the pillar.

Instantly his body is made completely weightless by the action of the floor degravitator. Having no weight, the body would float toward the ceiling if the Martian had not secured his head to the pillar. Consequently, he floats horizontally, but stays secure in one position. There is no more delightful sensation than complete weightlessness—the body freed from gravitational pull.

In 15 minutes one obtains more *real* rest than during a whole night's rest in bed. We already had experienced this in our space flyer during our Earth-Mars trip. Now we could understand why the Martians retire to their restrooms for 15 minutes once or twice during the Martian 24-hour day.

Let earthlings not wonder too much about the never-sleeping Martians. The human heart, too, never "sleeps" during man's entire lifetime. True, the heart does *not* beat *constantly*. It, too, must relax—indeed during 24 hours, it normally works only 12 hours. But when you run or exert yourself, then your heart beats faster, getting less and less rest.

Mars Not for Humans

This account is written in our underground home—in our fluid, "one"-room apartment. The Martians have provided air pressurization; otherwise we would have had to wear our plastex sphere helmets constantly. The apartment therefore has the same air pressure as on earth—14.7 pounds per square inch. Our boots also provide us with the necessary oxygen for the tanks strapped to our backs, whenever we leave our householock.

The Martians throughout their long evolution have become used to their thin atmosphere, which is as thin as that of our upper stratosphere. Humans, however, cannot live in such an oxygen-poor, pressureless air. Without our helmets we would immediately gasp for air and become unconscious in a few minutes.

Conversely, when our Martian leader visits us in our home, *he* must wear a helmet, else he would soon choke to death in our high-pressure atmosphere. The Martians having no mouth like ours, nor teeth, but a sort of beak, and living in a tenuous atmosphere, they do not speak like humans, as already explained —they make whistling sounds not unlike birds. They have a wide range of musical sounds. Despite their telepathic organs, they normally converse by sound.

When this is not possible—remember sounds do not carry far in the rarefied air—they communicate by thought waves. In the huge auditoriums, even when their musical sounds are amplified, the "speakers," actors, or performers usually employ telepathy as well. They do this to put their talks or performance over more emphatically. It also expresses the personality far more forcefully.

Martian Politics

There is naturally no such absurdity on Mars as different nations. There is only one "nation"—the entire race of 2 billion Martians. There is little politics on Mars, as we understand the term, chiefly because candidates are universally elected for life after they have reached their 2,000th year. This system discourages the usual political rivalry known on earth. It also makes for an ideal stability in all "national," regional, and local offices. Every officeholder thus becomes an institution. Surprisingly, the average Martian keeps a very sharp eye on every official. Indeed, she or he is under continuous fire—this keeps all officeholders on their toes. They are seldom replaced.

Resting Martian: Sleep being unknown on Mars, Martians nevertheless have short rest periods during day. Above is a male in *degravitator* room, freed from gravitation, completely relaxed. Fast *moving* hypnotic wall-patterns keep him immobile.

Synthetic Food

For more than a billion years, the Martians have "grown" their own food synthetically (see page 9). They eat no animal food of any kind, although they did so in prehistoric times. What little is actually grown on trees, such as fruit, nuts, etc., is pure "luxury food" and represents less than 10% of the total.

Martian food engineers—*pateilogists*—can produce billions of food combinations, surpassing anything we know on earth. Simply by juggling the atomic content of the raw materials, *any* type of food can be made and *any* desired

taste can be given to it. Practically all synthetic foods are stable at room temperature and will not spoil for centuries if kept in hermetically sealed containers, because all Martian foods are bacteriales —contain no micro-organisms of any kind—thus there is nothing in their content to ever spoil them.

Every day we eat "steaks," far better than the best terrestrial filets mignon; "potatoes," delicious beyond compare; desserts that are an everlasting delight to us; "milk," rich and creamy—yet everything we eat is purely artificial food.

Martian Protein Works

We visited one of the mammoth protein works, but naturally could not make head nor tail out of what was going on. There were hundreds of vats, tanks, labyrinths of huge, weird tubes, ovens, mixers, atomic converters, cosmic "blenders"—and thousands upon thousands of outlandish instruments, gauges, and manipulators. At one end of the plant, reddish-looking sand and a thick brown fluid came in—at the other end a constant stream of packaged food flowed out to be distributed by underground conveyors to storage plants.

Remote Control Workers

Yet there was not a single Martian in this huge plant which manufactured over 6,000 tons of protein food daily. Next we went to the control room from whence the entire plant was run by remote manipulation. This was above the main plant and housed only 15 technicians. Here we saw a forest of instruments, knobs, and hand controls on large panel signal boards. In comfortable reclining chairs, suspended from the ceiling, the technicians watched the instruments before them. In one hand they held recorders on which holes were punched by them into a metal ribbon. This was their "log book." We noted many television-like panels which allowed the workers to watch any operation in the actual factory that contained not a single worker.

Martian Food Magic

What was not immediately apparent when we watched the packaged food emerging on the conveyors was one amazing factor. It only became clear when we picked up a small package about the size of one of our breakfast cereal cartons. It was astonishingly heavy —it must have weighed over fifteen Martian pounds! All Martian foods are highly atom-compressed. This not only saves a tremendous amount of space, but, when shipped, most food items are not "aged."

We asked to open one of the "steak" boxes. It contained a great quantity of brown, round disks about the size of a twenty-five cent piece, but over twice that thick. Our mentor took one of them and placed it on a round plate that resembled plastic. He then reached into the scalelike skirt hung from his waist and brought out a pencil-like gadget with some small knobs on two sides.

He now pointed one end of the "pencil" at the brown disc, and before our astonished eyes it quickly expanded in all directions till it measured about 4 inches in diameter by 1 inch thick. While this transformation took place, the appetizing round object started to "steam" and sizzle; and if our heads had not been encased in our airtight helmets, we would have inhaled a delightful, meaty, warm aroma. Within 10 seconds, the "steak"—for such it was—was cooked, ready for eating.

The pencil gadget was an atomic instrument that rearranges the atoms in the "green" compressed steak and then cooks it by atomic energy.

A large, hot glass of milk is made in similar fashion merely by taking a little white tablet ¼ by ⅛ inch in size, dropping it into a glass, and pointing the atomic pencil at it. *No water is added,* all water being atomically locked in the original tablet.

It should be understood that all foods are compressed with their necessary seasoning, sauces, etc. Naturally there is a wide variety to choose from.

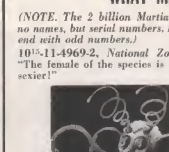
Incidentally, when the Martian goes to an eating place, he merely orders the items, puts them on plates, into glasses, etc., then expands and cooks or heats them himself. No one touches his food except him. The atomic pencil can supply any degree of heat desired. For foods requiring expansion (molecular expansion causes heat also), only the "expanding" button is used.

Water, the most precious Martian commodity, is meter-rationed. Every person is allowed 210 *didisis* of fluid per Martian month (60 earth days). The meter shuts off automatically if the household quota is exceeded. All used water is reprocessed *ato-chemically* in the house-block.

WHAT MARTIANS ARE SAYING

(NOTE. The 2 billion Martians have no names, but serial numbers. Females end with odd numbers.)

10[15]-11-4969-2, *National Zoologist:* "The female of the species is still the sexier!"



Tasting Electronic Music

10[15]-31-2169-14, *National Medicoördinator:* "The council must warn our population emphatically once more against the excessive use of gaseous food inhalation. If taken exclusively over long periods, serious *telepathology* follows. Keep gaseous food below 20% of total diet."

10[15]-8-97-169-17-12, *National Research-Telepathist:* "How far apart in the evolutionary scale we and the Earth people are is best observed when we see them asleep.

We who never sleep are deeply shocked when we actually see the revolting spectacle of beings—even with low-grade intelligence—wasting a third of their lives in useless somnolence. It is doubtful, when, if ever, they will develop our *antimorph* glands."

10[15]-59-67098-26, *National Religionist:* "The human race has produced one *and only* one individual who merits our complete admiration: the Hebraic Jesus Christ. Alas, his teachings continue to fall on deaf human ears."

10[15]-17-7889-99, *Feminaturalist:* "Sex, with our females, is still as modern as it was two billion years ago."

10[15]-16-95469-19, *National Actress* on her 2,500th birthday: "I am overcome with gratitude to my race who so overwhelmingly willed that I may now have a child."

10[15]-9-22269-16, *National Health Control:* "We must seriously protest the recent female vogue of excessive inhalation of intoxicating odors. Odor drunks are a National disgrace. It is worse than alcoholism."

10[15]-16-8879-24, *National Science Control:* "In another three billion and a half years, our *sands* which we now trans-mute into water will have given out. As a new source of raw material we will have to cut up our barren smaller moon, then the Asteroids."

10[15]-5-6656-8, *National Comic:* "As

Gaseous Food Inhalation

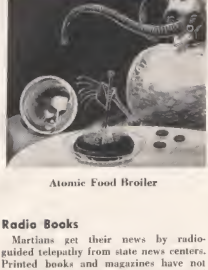
comical as a serious human."

10[15]-29-28982-16, *National Moralist:* "The most grotesque sentence ever coined in the Universe: *Peace on Earth* (Planet III)."

10[15]-19-46489-80, *National Gustomusicritic:* "The recent Gustonepoem,* by 10[15]-16-94861-60, now in such universal demand, has lifted the entire art to solar magnitudes."

10[15]-11-59911-79, *National Naturo-Educator:* "While interviewing the little humans of the earth expedition, I was more than astounded at their fierce, childish belief in heaven and hell after death. What ludicrous, abysmal gibberish! As if they did not have an overabundance of continuous hell on earth!"

*The Martians have combined music with electronic tasting. Earthlings are familiar with a strange taste sensation when for instance the two poles of a dry cell touch the tongue.



Atomic Food Broiler

Radio Books

Martians get their news by radio-guided telepathy from state news centers. Printed books and magazines have not been produced for many millions of years because of lack of space for the myriad-trillions of books.

Simple home radio receiver now micro-etches book pages (with or without illustrations) on thin, transparent, everlasting metal tape, about ¼ inch wide. Each micropage measures 1/16 inch high, by 1/32 inch wide. A 1,000-page book thus takes only a 31-inch-length paper-thin tape. To read the book you press a button. The tape then feeds into the *vision position*, and you read the pages on the screen, as fast or slow as desired. These "books" are all broadcast free by the state. Thousands of books can be stored in a single small reel that fits your hand.

Miniscule Humans

Currently the Martian home hobby is *microzoology*. Just as Japanese grow miniature trees, so Martians cultivate diminutive animals. They breed the counterpart of Martian horses, cattle, monkeys, and birds, as small as ants. These are raised in transparent table *zoolariums* among miniature trees, shrubs, and plants. The zoolariums are equipped with powerful magnifiers, so that the animals can be comfortably studied by the hobbyist at all times.

We were also shown an almost perfect, humanlike race of miniature people, bred by a Martian science-zoologist. The little men and women were less than ½ inch tall. By means of amplifiers you could hear them talk their weird language. They were still in an aboriginal stage, savage and naked. In about 4,000 years (850 generations) they would be at the same state of evolution as present-day humans, according to the scientist-breeder.

Atomic Chess

Greatest sport on Mars nowadays is a game which is best described by the term *atomic chess*. It is the most intellectual *tour de force* imaginable. The game is played with 126 "pieces"—all the Martian atomic elements. But the players use no actual "pieces"—it is all done mentally like blindfold chess. Each player plays with 126 different atoms which he must use in correct chemical combinations with the others. If he makes a mistake, he loses one or more atoms to his opponent. As there are billions of possible combinations, it takes a gigantic intellect to play the game rapidly, with only 10 seconds allowed between moves.

Every night for two hours, two giants of the game play a match, although the two players may be separated by thousands of miles. The contest, broadcast pictorially over every home screen on Mars, is followed breathlessly by well over a billion Martians.

Cosmic Pleasures

One of the baffling mysteries of Martian homelife which we could never understand—due to our limited senses—was the following:

Every evening at the same hour, all Martians, who were not at work, would relax and assume a curious posture. Their antennas curved till they almost met the projecting eyeballs. Soon an ecstatic expression would come over them and then their bodies became rigid. They stared fixedly into space for half an hour during which time no one could rouse them from their trance.

We understood this had something to do with a cosmic transmission that seemed to transport them into another world. One of our zoologists thought it had a connection with their sex life. But we never found out.

The Planet Comes First

The high-intelligence Martian civilization with its more than 2 billion years of evolution behind it, cannot possibly be compared with our own. Long evolution, voluntary selective breeding, have profoundly affected all Martian thinking, all customs, all living, to such an extent that we look, to Martians, like 20th grade savages.

Mars has no armed forces—what would they use them for? There are no criminals, consequently no jails. Policemen have been unknown for over a billion years. Labor troubles are unheard of. There are but few courts and they have little to do, outside of divorce cases.

All this, of course, stems back to the efficient planetwide, billion-year-old educational system which teaches that *first, whatever the individual does must be for the good of the planet, second for the race.*

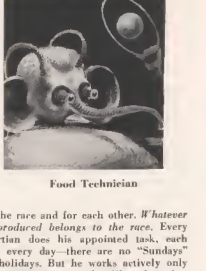
There is no such thing as a government as we know the term on earth. The Martian central organization is only a statistical body which gathers facts.

There are no "laws" as we know them, merely *Instructions* which everybody obeys as a matter of course. Just as the majority of Americans obey our street traffic lights—even if there is no policeman around.

No Money

There is, of course, no money and no such vicious, cancerous outgrowth as interest on money, no taxes. Consequently there is no such thing as business, as we know the term, because on Mars no one can make a profit.

For over a billion years Martians have been conditioned to work for the good



Food Technician

of the race and for each other. *Whatever is produced belongs to the race.* Every Martian does his appointed task, each and every day—there are no "Sundays" or holidays. But he works actively only for 20 Martian months. Then he takes off 4 months, for a vacation, if he wants. (The Martian year has 24 earth months.) Few Martians however take the full 4 months—the average is 2½ months.

Naturally, statistics are kept on his working time—not to check on his non-working hours, *but to keep him from putting in too much time.* Like the bee, the average Martian is overambitious and many workers over-exert themselves in their positions. This is frowned upon.

Fine living quarters, according to the size of the family, are assigned to every Martian over 30 years old. Naturally he does not pay for it in money.

The same is true for *all* his wants. He has merely to produce his metal card which gives his "name", i.e., his serial number, and he can "buy" anything he wants, anywhere. The electronic *stato-register*—connected with the Central Statistics Office—records the "sale" to his serial number and that is all. Incidentally, every item, be it a glass of milk or a piece of furniture, has an assigned number. This, when "bought", is recorded after his own serial number, thus completing the transaction. At the end of the year a complete accounting is sent to him. Each item is valued by a point system. Thus a dinner at a "restaurant" may run to 461 points, while a special cosmo-camera may run up to 16,000 points.

His work is credited to him in a given number of points, according to a universal scale. No Martian ever overdraws this point account—usually he is far below it and has credits coming to him.

Incentive

What then is the incentive for the Martian? What makes him work so furiously and so zealously? The average Martian has been bred for millions of years to think first of his planet—*THAT* is his spurring force—and he is proud of it. Many Martians distinguish themselves, but never for material reasons. The honor of doing something important, in the sciences, the arts, new inventions, new production, etc., is also a powerful motive.

(*Note.* This story was first printed in Hugo Gernsback's annual Christmas booklet "QUIP", December, 1949. Copyright 1949, by H. Gernsback.)

Science Questions and Answers

IN this department we will print every month letters from readers, particularly those letters that have to do with the science content of the stories published in this magazine. For the present, it will not be possible to answer questions by mail. If such a service can be rendered in later issues, we shall be happy to so inform you.

(1) Atomic Bomb on Planetoid

Editor,

Here is a question that has been bothering me for quite a while. I imagine it is one thing to explode an atomic or hydrogen bomb on Earth under atmospheric conditions, but exploding such bombs on a small planetary body where there is no air, would necessarily be a far different matter. I would like to know whether the damage done by an atomic bomb would be the same in either case?

Henry L. Nathan
Bronx, N. Y.

Answer:

As far as is known, there is no fundamental difference when it comes to the destructiveness of an atomic or hydrogen bomb either on Earth or on an airless planetoid, such as the Moon. The explosion will come off roughly the same, but there will, of course, be no sound waves nor shock waves on the Moon because there is no atmosphere to propagate them. The heat blast will however be in evidence. It is believed that wherever there is solid ground, as for instance on the Moon, the "mushroom" will be similar to the one on Earth, except that with no atmosphere and lessened gravity it will be dome-shaped on top and climb upward much faster. The "mushroom" will not *drift* or spread as on Earth, but most particles will most likely shoot out in all directions, away from the surface of the planetoid and will then be shot rapidly into free space and dissipate. For this to occur the gravity of the planet must be low enough to permit the explosion products to escape. On the Moon, or on an Asteroid, for example, atoms can readily escape. The radioactive particles which do not escape will fall back to the surface not far from where the bomb exploded.

As far as the destructiveness is concerned, the havoc raised on an extraterrestrial body will be every bit as vast as on Earth, and in many ways it will be much worse. Thus, on the Moon, where there is low gravity, and consequently low weight, the debris will be hurled much further. There is a possibility that other phenomena may be experienced, not as yet known from actual observation. One further point. The high temperatures produced by the bomb will cause great vaporization of materials, with a consequent formation of a type of atmosphere.

—Editor

(2) Space Sickness

Editor,

I understand that you are bringing out an entirely different kind of science fiction magazine which concerns itself more with the physical sciences. I have a question which I think you should be well qualified to answer. I have been reading a good deal about space sickness for the past few years and have been wondering if there is actually such a thing, as no one has ever been out in free space before and we have had no experience with "free falls." Can you give me the latest ideas about this? Also, who first thought about it?

Allan Newbolt
W. Phila, Pa.

Answer:

The Air Force for some time past has concerned itself actively with physiological conditions on man as they are likely to arise in free space. There is in existence a book entitled Space Medicine, published by the University of Illinois Press, Urbana, Ill., on which a number of experts have been working; the book gives a great many details on the subject. As far as is known, your editor was the first to point out this condition. He called it "space sickness." If you have a copy of his novel, RALPH 124C 41+, you will find out all about it on page 202 (Second Edition). The author went into the subject extensively. Here are two pertinent paragraphs written in 1911:

"Space sickness is one of the most unpleasant sensations that a human being can experience. Not all are subject to it, and it does not last longer than forty-eight hours, after which it never recurs.

"On Earth, gravitational action to a certain degree exerts a pull on the brain. Out in space, with practically no gravitational action, this pull ceases. When this happens, the brain is no longer subjected to the accustomed pull, and it expands slightly in all directions, just as a balloon loses its pear shape and becomes round when an aeronaut cuts loose, to drop down with his parachute."

There is no absolute certainty about space sickness today. While experimental trials have been made, they have been far too short in duration to come to any real conclusions. Mice sent up in one of the recent rockets fired by the Army—which were about a minute in a free fall—did not seem to be inconvenienced or harmed in any way. Again this does not make for scientific conclusions, because the length of time was too short. When human beings are subjected to a gravity-less condition for hours or days at a time, the result may be far different. As we well know, man walks upright and keeps his balance because of a small amount of liquid in the inner ear. If this liquid becomes weightless as it will in a free fall—scientists believe that this new condition could cause dizziness, nausea and perhaps "space sickness." But nobody can be certain about this until man has been in a free fall for at least hours at a time. The editor believes that, as in so many other unusual conditions, man will accommodate himself to a free fall, and that if space sickness is a reality, it may not last too long, as he pointed out in 1911.—*Editor.*

SCIENCE QUIZ

Test your scientific knowledge with this questionnaire. The answers are in the fiction stories on the pages listed.

1. How can spaceships avoid meteoric collisions?.. (p. 6)
2. How much does a 150-lb. man weigh on Mars?... (p. 6)
3. Are the two polar cops of Mars higher or lower in altitude than the rest of the planet's surface?.... (p. 10)
4. What is the temperature at the equator of Mars during the day? At night?.... (p. 61)
5. Who discovered the positron?.. (p. 51)
6. How would you define "heat"?.... (p. 51)
7. What is the maximum temperature theoretically possible? The minimum? What is the lowest temperature ever reached by scientists?.... (p. 50)
8. Name three types of prehistoric men... (p. 37)
9. How old is the species, *homo sapiens*?.... (p. 37)
10. How fast do alpha particles (alpha energy-waves) travel?.... (p. 26)
11. Have scientists succeeded in converting energy into matter? If so, when?.... (p. 26)

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Continued from inside front cover

ical doctors, but by doctors of physics. You have seen pictures of this improbable gadget many times, where atomic scientists handle "hot," that is, deadly, atomic substances, at a distance—usually separated from the lethal radiations by thick glass walls. By means of the mechanical hands, the physicist can make the most delicate experiments, pour dangerous liquids from a bottle into a test tube, and do anything he could do with his own hands. Recently television has been added to the *telehands* so a direct view of the experiments is no longer required. Now the physicist can be miles away, yet see exactly what he is doing with his distant, disembodied hands.

Some day a very learned psychologist will write an important book on the complex mental processes of inventing. The resumé will probably show that the inventor's mind absorbs all types of outside stimuli, experiences, and impressions which are then sorted and finally crystallized into an invention. In this process, many things that the inventor saw and heard in the past—ideas which he acquired while reading books, magazines, newspapers, technical writings of every kind, and so on—are used by his analytical mind. The end result—the invention—is therefore mostly a distillation of the inventor's outside impressions, plus his native ingenuity. Or as Edison put it more realistically: "An invention is ten per cent inspiration and ninety per cent perspiration!"

This brings me back to the vital rôle which the Science-Fiction author plays and has played in the past. Frequently he is the one who has furnished untold inspirations for the modern technical world in which we live. In fact, it is *he* who is often the actual inventor. Unfortunately, being only an author—which is his real métier—he is rarely interested commercially in his brain child. Worse yet, he does not believe in his heart that the idea is workable, or will ever be practical. So he hardly ever patents the idea, no matter how good it looks on paper.

Nor could you ever make him believe that five, ten, or thirty years later someone who read his original story will remember the idea, lard it with a few of his own, patent it and start a new billion dollar industry on it. Nevertheless this sort of thing happens continuously.

This sort of thing is so intimately woven into the warp and woof of the thing which we call "progress of civilization" that no man in his right senses would ever think of doing anything about it.

Once in a rare while, some of our great men *will* speak out. I quote the late and illustrious Dr. Michael Pupin, Professor of Electrical Engineering of Columbia University, and a famed inventor in his own right: "*To discover the need for an invention and to specify it, constitutes 50 per cent of the invention itself.*"

By this measure hundreds of authors have and will be deprived of the just fruits of their labor till someone does something about it. Nor is the amount, lost forever by our authors, a trifling one. At the present time it certainly cannot be less than between 50 and 100 millions of dollars a year for the United States alone. It will be much more a generation hence.

Perhaps what is needed is a patent reform. Today you cannot patent most mere ideas. Even if you can specify *all* the technical elements, a patent is not necessarily granted. The fundamental requirement for a patent is that *it must be new and it must work.* Frequently, skeptical patent examiners do not believe that a certain device described in a patent application will function. That is why they ask for a model—or else you must convince the Patent Office somehow that the device or process actually works.

Unfortunately many Science-Fiction authors are so far ahead of their times that most of their devices are impractical *at the time they describe them.*

Thus, Jules Verne's submarine, which he described minutely in 1870, could not have been patented, simply because at that time science and technology had not caught up with it—it could not have been built successfully in the seventies.

Nor could I have patented dozens of inventions now in everyday use and technically described at great length in *RALPH 124C 41+* in 1911. To name only a few: Radar (page 152), the radio direction finder (page 120), the Voice-Writer (page 128). The reason: in 1911 none of these inventions were workable—we had no modern vacuum tubes at the time nor amplifiers nor many other instrumentalities to actually operate and demonstrate these devices.

Accordingly, I believe that our patent laws should be revised so that ideas which appear feasible and technically sound to a qualified board of technical examiners will be given a "Provisional Patent." Let us assume that such a patent has a life of, say, 30 years. If, during this period the inventor cannot demonstrate the workability or feasibility of the device, the Provisional Patent will lapse. A regulation patent can then be applied for. The Provisional Patent will be the basis for the final patent.

A further, and most important point, is completely overlooked by both Science-Fiction authors and publishers today. It is, and has always been, the function and habit of the Patent Office to search all available pertaining records and *the public prints*, for the originality of the invention to be patented. Often the Patent Office will cite a magazine article which describes the identical device submitted by an inventor for a new patent. In that case the inventor will not be able to get the sweeping patent claims he could obtain, had he not been thus anticipated.

Now the point I would like to make is that I am quite certain that the Patent Office today does not routinely scan all the Science-Fiction stories which appear either in the Science-Fiction press or in general magazines. Why should it?

The remedy? It is exceedingly simple. Let author and publisher get together and agree that on advice from author—that his manuscript contains a new and feasible idea—the publisher will then print the story or book with a distinguishing mark or design.

I recently devised such a design—a five-pointed star resting on top of a sphere. The center of the sphere shows the letters SF. The symbolism: The star, is a light, on top of the world. In other words, Science-Fiction enlightens the world.

One final point: As the Father of Science-Fiction, I would like to make a serious plea. Science-Fiction has grown up to a stature no one would have believed possible 25 years ago. Today it is a force to reckon with. The public at large is beginning to take Science-Fiction seriously. People look to it confidently because they know that for the first time in the history of mankind—through the medium of Science-Fiction—man can now gaze into our future world with all its wonders—not with an uncertain look here and there—but with steady insight, month in and out and for all the years to follow.

For that reason, let us treat Science-Fiction with the seriousness and the dignity this great endeavor is everlastingly entitled to.


PAUL & Tina
THE SPIRIT OF SCIENCE-FICTION